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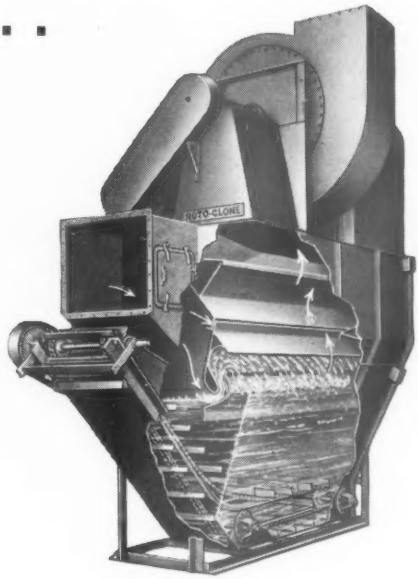

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Factory Report 1955—I

Sir George Barnett, the Chief Inspector of Factories, in his Annual Report* for 1955, points out that whilst the general trend of accidents tends to be lower, the actual number (to be viewed in relation to increased employment) rose by 1,874 to 163,332. In the foundry industry, where the number of accidents recorded was 9,674 there was an increase of 453. There were 16 fatal accidents as against 19 in 1954; it should be remembered, however, that in all sections of the industry there was increased activity. Considering factories as a whole, Sir George expressed concern at the increase in accidents to females and asked employers to exercise some measure of personal interest in the type of woman who is entering industry, coming from the home, shop, and office, as this "green" labour is particularly prone to accidents.

Half of chapter IV of the Report is devoted to a discussion of accidents in non-ferrous foundries where the total quoted was 1,250. It would seem, however, that this group represented something larger than the actual foundries, as reference is made to a 7-ft. long by 16-in. diameter billet being processed in a press shop. The major cause of accidents (283) was due to strains and the like, classified under "manhandling." Next on the list was burns (310) of which no fewer than 60 were eye injuries. Another 46 eye injuries resulted from the use of portable tools and miscellaneous causes. The statistics covering other types of accident in non-ferrous foundries follows the general trend of industry, but this question of burns still remains a problem. Many are due to the breaking of the rule that moisture must be rigorously excluded from contact with liquid metal. A case of an accident resulting from a wafer-thin crucible containing 500 lb. of liquid magnesium was due to poor inspection and a non-realization that a dross coating is not a crucible wall. In general, the eye injuries are attributed in the Report to the failure of men to use the goggles and screens provided for their use. The 228 accidents due to being struck by falling articles or materials, represents 18.2 per cent. of the total, and as there are many ton/miles consumed in non-ferrous foundries, this aspect needs special care. The question is raised as to whether there is not a better method available for cutting off runners and risers than by using a bandsaw, which is a prolific cause of accidents, though it is recognized to be a quick and convenient practice. The guarding of die-casting machines is said to be improving and further progress is expected as a result of the deliberations of a committee organized by the Zinc Alloy Die-Casters' Association.

There is a special chapter (number 20) on the Iron and Steel Foundry Regulations, 1953, where, by and large,

* "Annual Report of the Chief Inspector of Factories, for 1955," available from HM Stationery Office, price 9s. net.

Factory Report 1955—*I*

satisfaction is expressed with the progress made. We propose to deal at greater length with this next week; for the moment, comment is confined to one aspect only—the provision of bathing facilities. In December, 1955, the total number of iron and steel foundries on the Inspectorate's list was 1,850, of which 700 had fully complied with the Regulation; at 691 installation of facilities was in progress; at 389 nothing so far had been done, and in the remaining 70 cases, either exemption had been granted or was under consideration. Sir George assures us that to the best of his knowledge, no foundry has ceased operations because of this Regulation, and so contradicts the rumour that five have closed their doors solely on this account.

Retirement of Mr. E. Carey-Hill

Mr. E. Carey-Hill, deputy chairman of Dartmouth Auto Castings, Limited, Smethwick, is retiring on December 18, after 25 years with the Birmid group of companies. At an informal ceremony held yesterday to mark the occasion he was presented with a cabinet by the chairman, Mr. A. E. Pearce, on behalf of his fellow-directors, and a television set by Mr. W. Brindley, director, on behalf of the staff. Mr. Carey-Hill was previously managing director of Rowland Hill & Sons, Limited, a family business of aluminium founders in Coventry, which he entered in 1902 on his return from the Boer War.

Born in 1882 he was educated at Oundle, the Coventry Technical Institute and Birmingham Technical College; he was also a pupil at the Beeston Motor Cycle Company, the Motor Manufacturing Company, and the Daimler Company. Throughout his long career he has been closely allied with the motor industry and is at present relinquishing the office of chairman of the Automobile and Allied High Duty Ironfounders' Association, a position which he has held for the past three years. As a member of an old Coventry family he has been closely associated not only with Coventry but also with Kenilworth, where he has lived for 37 years.

Institute of Metal Awards

The Institute of Metals announce the following awards of medals for 1957:

The Institute's (Platinum) Medal to Dr. Maurice Cook, F.I.M., joint managing director, Imperial Chemical Industries, Limited, metals division, in recognition of his outstanding contribution to the science of metallurgy, to the non-ferrous metals industry and to the welfare of the metallurgical profession; and the Rosenhain Medal: to Dr. H. K. Hardy, A.R.S.M., A.I.M., research manager, United Kingdom Atomic Energy Authority, industrial group, in recognition of his outstanding contributions to knowledge in the field of physical metallurgy.

AN ORDER has been received by George Clark & North Eastern Marine (Sunderland), Limited, for a ship's engine of 9,100 h.p., which will be the biggest marine engine built on the River Wear.

Encouraging Co-operation

Emphasizing the need to encourage the few workpeople who were willing to take a constructive interest in works organization, Mr. A. B. Waring, chairman and managing director of Joseph Lucas, Limited, speaking in Birmingham on December 6, said that in all groups of people, industrial or otherwise, there was a small but critical number who could exercise a potent influence. Methods of encouragement varied, he added; in one instance, suggestion schemes had yielded 5,000 suggestions of which 1,471 were accepted and had resulted in economies of around £48,000 in 1955. Works committees, with representatives of the workpeople and also technicians, were formed to encourage such aspects of factory organization as fuel economy, materials handling, quality control and safety. The fuel-economy committee in its first year of operation in one factory alone had made suggestions which saved the equivalent of 1,000 tons of coal. In the period 1947 to 1955, fuel, equalling 68,000 tons of coal, was saved, representing £275,000. The safety committee had organized courses and lectures and other activities with the result that in one factory, which in 1947 had 28 accidents for every 1,000 people employed, a steady reduction of accidents had taken place so that the figure was now 8.2 per thousand employees.

Mr. Waring, who was addressing the members of the Non-Ferrous Club at their December luncheon, stressed the point that these activities should be regarded as part of normal works routine and management should use them to create a sense of continuous purpose. Not only did they contribute to good relations but also to sound economy. They were, he said, a means by which the capacity for criticism could be directed towards constructive ends. At this luncheon a collection was taken on behalf of the *Birmingham Post and Mail* Christmas-tree Fund, the sum of £25 2s. being collected. On the evening of December 6 the Club held its annual dinner/dance at Chadwick Manor Hotel.

Latest Foundry Statistics

The Ministry of Supply announces that the production of aluminium castings during September was 1,813 tons from sand moulds; 3,149 as gravity-die- and 1,082 as pressure-die-castings. This month also, the production of magnesium castings was 218 tons.

According to the British Bureau of Non-Ferrous Metal Statistics the production of brass ingots for remelting in the foundry during 1955 was 19,310 tons of which 18,910 were delivered. During October, 1956, the production of bronze and brass castings was 7,033 tons, whilst the gross output for the first ten months of the year was 64,190 as against 58,543 for the same period of 1955. Pure copper castings production amounted to 650 tons during October. The first ten months gave 6,500 as against 5,150 for this period during 1955.

Luncheon

H. C. HOPPER (KINGSTON), LIMITED

Mr. H. C. Hopper, of the foundry bearing his name, on December 6 presided over a luncheon party held at the Mitre Hotel, Hampton Court, Middlesex, to celebrate the opening of an extension to the Kingston premises which will double the manufacturing floor space. The luncheon was noteworthy, as the main course was a baron of beef. The 50 guests included customers, suppliers and competitors.

BSFA Customer/Founder Convention

New Phase of Co-operation between Various Interests

Abstracts from the papers and discussions at last month's customer/founder convention organized by the British Steel Founders' Association. At the previous convention in 1953, *the customers mainly aired grievances, but in the proceedings reported below, a much more tolerant and co-operative spirit was shown.*

As briefly announced in the FOUNDRY TRADE JOURNAL of November 22, a second customer/founder convention was staged in London by the British Steel Founders' Association at the Café Royal earlier in the month, occupying a whole day with technical contributions and discussions. In the Chair was Mr. G. M. Menzies (managing director, North British Steel Foundry, Limited), president of the Association.

Welcoming the delegates, Mr. Menzies referred to the first convention held three years ago and said the present one had a somewhat different objective, it was limited to one day and there was no accompanying exhibition. The new aim was to promote a series of sectional conferences, in different fields, between the Association and the main consumers of steel castings. Already, he said, with steel castings customer/founder consultation at the design stage is the rule rather than the exception. It may be asked, therefore, why BSFA should so ardently sponsor what appears to be a normal form of liaison. It is because steel castings are different from most other products in one important respect. Unlike most components of engineering structures, the vast majority of steel castings are produced without prototype work having been undertaken. Steel castings are invariably vital components in the structures of which they form a part, that is to say, they are highly stressed in one way or the other, and they must not fail in service otherwise such failure may be costly, in money certainly, even perhaps in terms of human life. That may sound a little melodramatic, yet it is a fact of which steelfounders are very conscious. Therefore, the production of components of this type, and for such critical performance, necessitates the application of a great deal of skill and judgment by founders. In many instances, these parts are produced one-off, and this means that a steelfounder has only one opportunity to be right, otherwise he is bound to lose money. A steelfounder will supply a replacement of a faulty casting, which makes him lose money, but such a necessity will frequently involve his customer in some sort of loss also. Sometimes the customer's loss could be greater than the steelfounder's, but the point is, *whoever* loses, it is a highly unsatisfactory matter.

Another sphere for fruitful intercourse between founders and their customers was to avoid the sort of duplication such as could be pictured when six different foundry concerns were working out methods to produce the same (difficult) design of casting—not only should there be liaison on a firm-to-firm basis but also on an industry-to-industry footing.

"Acceptance Standards"

After next briefly reviewing the day's programme, Mr. Menzies called on Mr. A. C. Annis (Metropolitan-Vickers Electrical Company, Limited) to give his paper "Acceptance Standards for Steel Castings for Electricity, Generating Plant and Marine Propulsion Machinery."

Mr. Annis began by saying that British steelfounders manufactured castings of every conceivable size, weight and shape, under something like sixteen separate headings, for general engineering purposes, from earth-moving equipment to high-pressure, high-temperature electricity-generating plant. In this range of headings, electricity-generating plant, marine-propulsion machinery, chemical plant and oil refineries, used steel castings which were to be considered as pressure vessels, while steel castings under the remaining twelve headings were preponderantly required for mechanical or structural functions. Founders had stated, and it had to be universally accepted, that "while castings must be adequate functionally, perfection is no desideratum, where there was no functional significance." Thus, with this wide variety of steel castings there were equally wide considerations as to functional significance to be considered—with pressure vessels, representing virtually 100 per cent. functional significance. This conception was implicit in the title of the Paper—"Acceptance Standards"—from which it was implied also that absolute soundness of sand-cast steel castings (as-cast) was not attainable. This stemmed from the natural laws governing the behaviour of molten steel poured into a mould, and in consequence, welding repair of sand-cast steel castings was a recognized and accepted foundry manufacturing process.

On the understanding that defects had been determined by the founders at the inspection stage, the next requirement was understanding to the necessary welding repairs, that was between founder, user and customer and the customer's surveying and inspection representatives. As the BSFA wisely recognized the need for obtaining, with complete freedom and frankness, the customer's (the user's) experience and views of steel castings, then it was equally incumbent on users freely and frankly to inform and advise their customer's representatives as to the whole situation stemming from steel-casting problems.

Classification of Defects

Instead of referring to major, minor or trivial defects, requiring weld repairs, it was desirable that the founder should only approach the customer regarding notifiable defects, these being such as

Customer/Founder Convention

were the subject of drawings or sketches submitted to the ultimate customer for approval after full consideration by the user's chief design engineer, chief metallurgist and manufacturing superintendent. This classification would exclude small defects requiring weld repairs carried out with the agreement of the ultimate customer's resident inspector, who, from experience could give approval direct and record having done so.

Mr Annis said he had established, with the full agreement of all concerned, that trivial and minor defects which had been removed completely (as proved by magnetic-particle testing) would not be welded if they were of insignificant depth in relation to scantling thickness and not of such configuration as to form stress-raisers, provided the area in question had no locational function. This piece of commonsense—not a concession—could and did save much delay and unnecessary risks of local distortion. [Here, the Author exhibited slides showing defects removed, but not replaced by welding because the area in question had no functional significance. Other examples were shown where welding was unsatisfactory and the area had to be rewelded.]

Casting users sometimes found during machining operations cracked and porous welds; good welds with boundary cracks in poor parent metal, and, frequently, there was poor-quality steel in the region of risers due to segregation of carbon, sulphur and phosphorus, with resulting hot-short metal, unable to withstand shrinkage stresses, especially if there was no pre-heating, or insufficient pre-heating to reduce shrinkages to a minimum. Such cases usually arose from a timidity to make a weld preparation large enough to provide sound metal for the weld repairs, in case the mutilation itself appeared to invite rejection. This was illustrated by a slide of a turbine valve-chest which had been so rejected by all concerned, but which he, Mr. Annis, succeeded in salvaging after re-submission and a full-scale discussion. It had been in satisfactory service now for three years, but it had been soundly repaired under fully recorded and documented metallurgical control. Thus, he said to steelfounders, "Go thou and do likewise—after notification and approval by the customer." His motto was: don't be afraid to make large enough preparation for welding. He considered himself second to none in his respect and admiration for steelfoundry managers, but they should not control the inspection of their own work, no more than he was allowed to control inspection of his, as a turbine maker. There had to be a separate section of the foundry for inspection and welding repairs under metallurgical control. Only in this way could one hope to acquire the confidence of the customer in the reliability of weld repairs.

Pre-heating Temperature Ranges

A vexed question was that of the temperature range for pre-heating prior to welding when (and this was quite frequent in the case of pressure vessels) pre-heating was necessary. Bs 592—"Carbon Steel Castings"—specified a range from 150 to 300 deg. C. and while this might be satisfactory according to location and surrounding mass (and in some cases pre-heating might not be essential at all), this range was too low for alloy-steel castings, and a range of 300 to 400 deg. C. was essential to avoid under-bead cracking. The British Standards for alloy-steel castings, including the higher-heat-resisting compositions, continued to specify the 150 to 300 deg. C. range. At the present time, all the British Standards for steel castings for "general engineering purposes" were under review by BS Technical Committee ISE/6, under Draft CW (I.S.E.) 7213, but it was thought preferable that steel castings for electricity-generating plant and marine-propulsion machinery be considered for separate specifications as in the case of "Carbon and Alloy Steel Castings for Chemical Vessels," BSS 504-5 and 6—when no doubt this and other aspects requiring attention would be dealt with.

Cast/Weld Structures

Considerable progress had been made in the dissection of complex designs to provide separate weldments—either as castings or forgings—for welding to a parent cast structure. This would be very difficult and costly from the designer's point of view, but he was always willing to reduce in some measure, at least, the founder's perplexities. Experience to date with the Author's company had however been discouraging. The parent and offspring castings had shown little or no improvement, as-cast, over the original integral castings. Worse than this, the joining surfaces had sometimes presented unsatisfactory metal when machined for weld preparations and some castings had to have metal removed and repaired by welding before a reliable weld preparation for assembly was obtainable. This is not the end of the story of course, but clearly some more purposeful understanding and intentions has to result in better performance, in order to justify this otherwise quite logical development.

The great aim in heavy engineering industry was "chipless production," and this was best approached by pouring molten metal into a suitably shaped mould. This was best defined, said Mr. Annis, by Harris in the American *Aviation Age* as being "... much more logical and desirable to pour out metal directly to the form required than to 'beat hell out of a casting' (*i.e.* ingot), to make a forging. Especially when a forging requires extensive machining, not to mention being rolled to sheet for cutting into bits and pieces, that must then be stuck back together, the whole process producing more chips than product by hogging." There was, thus, a challenge to steelfounders to produce forging-quality castings, for cast/weld designs, which could provide satisfactory weld preparations when machined. [A slide of a turbine casing "hogged" from a solid forging illustrated this point.] In this same context, Mr. Annis went on, many large power-station installations required high-pressure steam connecting pipes of hairpin-bend formation with a cast-steel bend of small radius welded to heavy-gauge seamless tube in straight lengths of

comparatively large bore diameters, the requirements being as generally indicated in BS 806:54, "Ferrous Pipes and Piping Installations." Great difficulty was experienced by pipe makers in obtaining such castings free from serious defects, and with satisfactory weld preparations when machined. This again was a challenge to steelfounders. In yet another field, still unobtainable by valve makers, were free-from-sand castings for generating-plant and marine-propulsion lubricating and servo-motor oil systems. An alternative which now offered better prospects of usable castings was ductile iron. Were the steelfounders going to let this business go?

Considering steel castings for mechanical and structural components, here, also, there were wide disparities as to functional significance. He had in mind, particularly, steel castings for rotating elements subject to significant centrifugal stresses. Examples were rotors for very large electric motors for steel rolling mills—say of 3,000 to 4,000 h.p. rating. For these, integral steel castings have been superseded by cast/weld structures based on a cast-steel hub, as the only cast member. Even now, these cast hubs were being extensively superseded by forgings and designs were tending to become "Meccano"-like fabricated structures, due to declining confidence in the reliability of steel castings in the as-cast state. Yet, the steel casting, if sound, was the correct solution to such requirements.

Discussion

When the meeting was opened for discussion, one speaker—having in mind that when a steel casting was newly taken from its mould, it only represented a beginning—said steelfounders should be allowed to do enough machining on certain items to permit full-pressure testing.

Mr. Annis replied that he agreed in principle but it was only final machining that rendered proper assessment of the value of full hydraulic-pressure testing. In answer to a further question, he said that air-pressure testing of castings was not so reliable as hydraulic testing and could be more dangerous.

Several speakers, amongst them founders, agreed that perhaps their weld repairs on castings were not undertaken with sufficient seriousness or were the welders always adequately skilled. It was clear that this was a subject which would repay careful examination and, perhaps, the institution of a "Code of Practice." Other points put forward were that some founders were overmuch concerned with appearance to the detriment of soundness when welding; that there ought to be more machining of castings at foundries; that the documentation of defects *vis-à-vis* particular patterns should be improved, and that sometimes—as a legacy, perhaps, of the "bad old days"—founders were too skinny with molten metal when it came to providing for adequate feeding.

"Fulfilling Requirements"

After an interval for coffee, the delegates reassembled to hear a paper entitled "Fulfilling Requirements" by Dr. C. J. Dadswell, B.SC., M.I.MECH.E. (director, English Steel Castings Corporation, Limited, and vice-chairman, BSFA). He began by saying that Mr. Annis had described some of the conditions which had been, or should be, fulfilled by a steel casting, but in fairness, the turbine castings and similar items he had referred to were not representative of the "run of the mill" and only made up 1 per cent. of the total tonnage. His interpretation (Dr. Dadswell's) of the field of requirements—which he hoped to describe founders' ability to fulfil—was necessarily a little wider. On design, he would not suggest that every time a casting was prepared, one should call in a group of steelfounders to discuss whether the design was one which could be satisfactorily produced, but steelfounding lent itself to such complicated forms of construction that it was in the more complex shapes where trouble could be avoided if there were prior discussions. It was seldom, in engineering or other walks of life, that there was not more than one answer to a problem—in fact, there was *always* more than one way in steelfounding. Steelfounding was not yet an exact science; he claimed, however, that it was becoming less inexact than in the past and that, whilst experience still counted, it was less "rule of thumb," there being means of estimation now of how to feed varying sections of steel which at one time was done entirely by guesswork. It should be remembered that a casting whether it be in steel or other metal, was unlike any other form of metal forming, in that its final shape—subject to some machining and other dressing—was the form in which the metal was first poured, *i.e.*, it was all done "in one jump."

Quality

On the question of quality, Dr. Dadswell claimed that to-day's quality of steel casting was higher than ever before. There were many reasons for this—technological advance, of course, being the principal one, but this advance had been encouraged by the demand of the customer for reliable products; by competition between steelfounders to retain and extend markets from other founders and from other forms of construction by superior comparative quality, and by competing on quality rather than price. He thought that nowadays unbridled competition would not have such dire defects because of the technological pride founders took in their products. Nevertheless, he was afraid that the price of survival could over-reach technological prudence and hoped for the sake of the customer, to whom founders were trying to prove that they could satisfy his demand, that the economies of price warfare, which could destroy quality, would not again be forced on founders.

Testing, went on Dr. Dadswell, was like insurance—the more eventualities for which one wanted to cover, the more one had to pay, and it was just as unfair to say that the founders were unreasonable when they wanted to charge for special testing (and the extra work which was involved on the casting) as it would be to complain about an insurance company which increased its charges for undertaking cover on an increased value.

Customer/Founder Convention

Price and Delivery

Mention had already been made of costs, but it was not always realized by purchasers that the overall prices of steel castings had not risen as much as many other commodities, and he believed he was right in saying that the increased cost of steel castings related to pre-war castings was less than the comparative index showed for the rise in the cost of general engineering products. This was in spite of increased quality and the greater amount of work which was done by the founder. Thus, productivity and efficiency was rising, as was confirmed by statistics. In comparing the price of steel castings with other products, the customer should look at the final component price, as the steel casting was incorporated into its final assembly.

All British manufacturers seemed to be under a cloud of complaints of unfulfilled delivery promises. One experienced this in purchasing material for the works and one heard it from overseas buyers. Was it a complaint arising from the complacency of the country's full order-book for so many years? He did not think so; more likely, it was that British industry was trying to do too much. As far as founders were concerned, there were many operations from the time of putting a pattern into sand and pouring metal, to the casting leaving a foundry ready for use or for further operations, but he would like to think that in the same way as there had been technological advance, there had also been management advance in steelfoundries. It was true to say that those in the steelfoundry industry were as enlightened as in other branches of the engineering industry in having management control of processes through the various stages of production, thus regulating the sequence of operations, without delays.

Applications

A bigger tonnage of castings in this and other countries was now made than in pre-war days. Despite this, steel castings, as with other forms of engineering, must inevitably give way at times to alternative materials as these were developed, but in the same manner, evolution brought increased applications and cast-steel products gained more ground than competitive forms because of the very properties they possessed. It might not be possible to prove this in comparing it with steel forgings, although the claim had been made, but there was certainly evidence that cast forms of construction had better properties than built-up structures produced by welding and fabrication. Furthermore, on occasions, by using cast/weld structures, one could by suitable design of the cast parts, bring the welded joint away from highly-stressed areas, *e.g.* at T-junctions. Delegates should not be discouraged by Mr. Annis's remarks in this context, Dr. Dadswell added.

A very important point, especially under current conditions, was that the purchase of steel castings had two marked advantages for engineering works. First, steel castings were available under reasonable delivery conditions as compared with the difficulty in obtaining steel sections, and second, the purchase of a casting might be semi-finished or maybe even finished ready for assembly, which fact freed capacity in the engineering customers' works, where otherwise fabrications would take up labour and space. This labour and space was then available for machining and finished-component assembly which was the legitimate business of the engineer. Perhaps even the swing towards fabrication in the recent past had been due partly to the reverse of this situation. He concluded by saying steelfounders must have "faith" but they were creators, trying always for the elusive "perfection." They could help one another in extending applications and perfecting those which already existed. One of the objectives of this convention was to encourage exchange of ideas between steelfounders and groups of casting users. This meeting should decide that individual firms ought always to be frank in exchanging ideas, but it should also decide to arrange for group discussions and group regional discussions.

Founders Too Modest ?

Discussion at this point was opened by a delegate from a marine inspection authority, saying that defects in castings sometimes escaped detection and then caused trouble in distant ports, where replacement was costly to a degree much removed from the actual cost of the component. Was this kind of defect due to the increasing adoption of electric-furnace steel?

Dr. Dadswell countered this by saying that in the valve-casting field, for instance, UK founders were selling in the United States as a result of improved inspection giving castings of better quality than were available domestically in that country. He did not agree that electric melting could be held responsible for any premature failure or lack of soundness.

Another speaker intervened to allege that steelfounders were too modest, and instanced the way in which they had organized research facilities of superlative quality to aid in their desire to produce still better castings and give improved service to engineers. The future, he said, would see more—and perhaps quite spectacular—advances resulting from their enlightened use of "down-to-earth" research.

A succession of questions and replies followed on such topics as the alleged desirability of "Classes of Use" and "Codes of Inspection" for important castings and on whether the individual founder or the BSFA should be consulted by a customer in difficulty—the reply in this latter case being, "the founder, who could refer to the BSFA if necessary."

Luncheon

This ended the morning session and the convention adjourned for luncheon in an adjacent hall of the Café Royal. Here, after the "Loyal" toast, the chairman (Mr. G. M. Menzies) proposed the toast of the "Guests" saying *inter alia* that over 30 office-bearers in learned societies were present. He also thanked Mr. F. Crerar, C.B.E., A.D.C. (W. Shaw & Company, Limited) who had arranged that function. The reply was made by Sir Steuart

Mitchell, K.B.E., C.B., Controller of Ordnance Factories, who declared himself very impressed with the candid manner in which delegates, among both founders and their customers, were examining common problems. If, he said, any members attending a regional conference found themselves in the Leeds area, he would be pleased to arrange for a party of them to see the uses to which steel castings were put at a tank factory nearby, which came under his administration.

"The Surveyor's Viewpoint"

Upon resumption of the proceedings, a paper "The Surveyor's Viewpoint on Steel Castings" by S. F. Dorey, C.B.E., D.SC., F.R.S., HON.M.I.MECH.E. (chief engineer surveyor, Lloyd's Register of Shipping), was read (in the Author's absence owing to indisposition) by his colleague Mr. T. W. Bushell.

Dr. Dorey, in representing the views of a surveyor, said it might be claimed that his experience was gained in a three-fold manner, namely, through inspection service at the foundry, approval of contract work at the engineering works or purchasers' works, and the behaviour of the accepted article in the service of the user. With such an audience as was assembled, it was not out of place to say that the majority of users of steel castings, and, in particular, castings which had to withstand pressure, were sometimes not satisfied with the products they received from the foundry and were fully cognizant of the fact that castings were very rarely free from defect—meaning any imperfection whatever. These remarks were as true 30 years ago as they were to-day, since, while on the one hand much progress had been made in the art of founding and there was closer collaboration between designer and foundryman, with the progress of time, castings had become subject to more onerous conditions which not only called for greater freedom from defects but also improved methods of inspection. Modern high-temperature, high-pressure parts could no longer be accepted on the basis of the older inspection methods, some of which indeed were a relic of the days when steel castings replaced iron castings used formerly. Too frequently had the expression "sound and free from defects" been used in specifications: improved methods of testing for soundness had undoubtedly justified their usefulness, but "freedom from defects" had certainly "gone by the board." What was required was an appreciation of the defects encountered and a decision as to how they could be dealt with to prevent condemnation and wastage. The surveyor's proper attitude should be that his job was to pass and not just reject. Anyone could condemn a casting, but it required experience in most cases to recommend repairs, and then to see them carried out satisfactorily in order to pass the product.

Marine Castings

Dealing specifically with general marine steel castings, Dr. Dorey wrote that the incidence and type of defect most frequently met in steel castings were "contraction cracks," which were liable to be found or be developed at corners, at junctures of all sections or at sharp changes of section. These defects, which might vary in extension and depth, could not, in all cases, be attributed to defective foundry technique only. Incorrect design of the casting was, in several cases, the most contributory factor. There was a tendency among foundrymen to devote energy to the production of the casting "as designed," without bringing to the attention of the designer modifications which would improve the quality and the ability of the casting to withstand stresses set up in cooling and imposed in service. Sand inclusions, shrinkage defects and porosity were also still prevalent, but with the improvement of casting technique and the precautions taken at all stages during the manufacturing process, the incidence of these defects was showing a tendency to decrease.

Composite Constructions

For large castings of intricate design (turbine casings and entablatures of high-speed oil-engines, stern-frames, etc.), the practice becoming the vogue in certain foundries (when it was not practicable to use mild-steel plate fabrication) was to cast separate components of limited sizes which were most easily obtainable in a sound condition, and afterwards assembling them and joining by welding. It was important in these cases that some general principles in the manufacturing assembly be observed, *e.g.*, quality of material, positions of welds, welding technique. procedure and sequence, and heat-treatment of the assembly. The advantages of this practice were obvious, even if the cost of the assembly were higher than the original casting. It was essential that the welding should be carried out in a properly equipped welding shop, in charge of a well-trained welding engineer, and *not in the foundry*.

Variations between Foundries

Particulars had been obtained, wrote Dr. Dorey in a later section of his Paper, from 15 foundries in foreign countries having a large shipbuilding programme, nine being for large castings and six for small castings. In the case of the large and small castings, percentages of defects and rejections varied appreciably from one works to another but were summarized for a one-year period as follow:—

		Defects per cent.	Rejects per cent.
Large castings—			
Firm's inspection ..	Surface defects	25 to 45	1 to 5
	Internal defects	2 to 5	½ to 2
Surveyor's inspection	Surface defects		0 to 3
			0 to 2
Small castings—			
Firm's inspection ..	Surface defects	1 to 6	0.3 to 2
	Internal defects	3 to 2	0 to 2
Surveyor's inspection	Surface defects		0 to 4
	Internal defects		0 to 2

At one important steel district in this country (UK) where the general level of casting quality was fairly high, as much variation of quality could and did take place in a period at one foundry as took place between foundries. To quote one large

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foundry in this district, the types of defects encountered were: (*a*) Internal shrinkage, usually in the way of headers, changes of mass and shape; (*b*) inclusions, including sand from moulds and cores; (*c*) hot-tears; (*d*) porosity/gas holes; (*e*) unfused chaplets and (*f*) lapping and cracks. In the case of heavy castings, such as turbine casings, oil-engine cylinders, etc., the relative proportions of the defects were approximately:

	per cent.		per cent.
Defect (*a*)	70	Defect (*d*)	25
(*b*)	10	(*e*)	2
(*c*)	10	(*f*)	1

For lighter castings, such as valve bodies, nozzle boxes, etc., the proportions were given as:—

	per cent.		per cent.
Defect (*d*)	25	Defect (*a*)	50
(*e*)	2	(*b*)	20
(*f*)	1	(*c*)	2

It was reported that improvements had been made by modifying the characteristics of the moulding sand and by experimenting with the positioning and capacity of gates and risers. That sort of procedure was normally to be expected.

Specialization

Most foundries would generally have a type or types of castings at which they excelled, and others at which they were often not so good. It frequently happened that a founder was over-persuaded by a customer to take on certain castings outside his usual experience, and in which the foundry workers were not so interested, with consequent bad results. It was far better to specialize and to pass orders outside the range over to other specialists. To broaden the scope or range of materials was often an unwise policy, as it gave a tendency to employ one quality of material or one cast for too wide a variety of specifications, with consequent higher wastage due to defects. Similarly, it would be wrong to select an expensive alloy steel for duties which would be adequately met by mild steel.

General Improvement Registered

There were, Dr. Dorey wrote, foundries producing to-day very nearly perfect castings of types which would have been deemed impossible to make in steel 20 years ago. [Excellent examples of these were to be seen illustrated at the present convention, Mr. Bushell added.] Again, there were foundries which still failed to produce a really good casting of the simplest design. Comparisons were nearly always odious, but there was some excuse for severe criticism from a surveyor, who, serving two foundries, consistently met 90 to 95 per cent. excellence in one and perhaps 10 per cent. in the other and that sort of thing was not unknown. It was the latter type of foundry which had done much harm to the industry as a whole.

Dr. Dorey did not propose to discuss the method of mechanical testing of test-pieces taken from steel castings—beyond saying that the surveyor must satisfy himself that the test blocks on castings were so located that the metal was representative of the casting proper. Test blocks should, he averred, wherever practical, be cast integral with the castings and should not be removed until the prescribed heat-treatment had been completed and adequate identification markings had been established. Rejection due to mechanical testing on the whole was low, however—something of the order of 1 per cent.

Non-destructive Testing

In recent years, many of the scientific developments of the era had found increasing application in the field of non-destructive testing and inspection of castings, and as a result, there had been marked improvement in the quality of steel castings generally. Specialized methods of non-destructive testing, such as radiography, ultrasonic testing, etc., called for experienced operators and, more important, still more experienced interpretation. It could not be too strongly emphasized that, from a surveyor's point of view, a keen and appreciative eye, with adequate lighting and handling facilities in the inspection bay, was still a most important part of steel-casting inspection, and the preparation and fettling of the casting should be carried out with this in mind. The surveyor should discourage any form of dressing of casting surfaces which tended to cover rather than expose the true condition below, and shotblasting was a case in point. Perhaps the most satisfactory condition in which to examine a casting was in the pickled condition and an increasing number of important castings were now being pickled as a matter of routine. Inefficient cleaning after pickling had, however, given very rapid corrosion attack in some cases, in service.

A prototype casting should, whenever possible, be made when important castings for high-duty service conditions were envisaged. Then, when a satisfactory casting technique had been established from a number of non-destructive tests correlated with sectioning, inspection could be confined to visual examination and dimensional check, unless the requirements of the order specified additional tests. With pressure testing, experience indicated that a high test-pressure for a short duration was not so effective for revealing defects in castings as a lower pressure for a long period. All fillets of heavy connections should be ground to help in the early detection of cracks.

Rectification

In Dr. Dorey's opinion, castings should not be rectified before being submitted to the surveyor for inspection. The full extent of the surface defects should be ascertained and the advisability of repair by welding considered before any such operation was carried out. It was a serious matter, he thought, to remove the sound wall of a casting in order to explore or remove some minor blemish, and on occasions it was doubtful if the ultimate repair was any more satisfactory than the original condition. Castings liable to be highly stressed where suspect should be radiographed, especially

following a welding repair of some magnitude, or a repair effected in a position difficult of access. The extent of the weld repairs would determine the need or otherwise for the entire casting to be re-heat-treated. Repetitive faults were matters which should receive the attention of the foundry manager and works metallurgist immediately, and it was usually possible, he found, to eliminate them by suitable modifications in practice. However, with so many variables to consider and in the very nature of handling large quantities of liquid steel, certain defects occurred from time to time which must be dealt with. In these cases, it was most important that the full extent of the trouble be exposed, in fact it would be a good thing if, in dealing with casting defects at the foundry, the founder took the same view as the surgeon in dealing with a case of malignant growth, and "cut wide and cut deep."

Service Failures

Dealing with types of service failures most frequently met with, Dr. Dorey wrote that failure of well-designed, well made steel castings was very rare It could seldom be said that a particular type of casting gave trouble regularly; in fact, it was often found that a series of castings would have worked admirably over a number of years and, without warning, a number of defects be revealed extending over a certain period. Perhaps the most frequent case of trouble was with pressure-resisting castings where occasionally after a short period of service it was found that operating conditions had resulted in varying degrees of erosion and occasionally of cracking, the latter occurring usually near a bracket or a change of section. Whilst the types of defects met frequently followed a pattern, the time of occurrence varied considerably, and would appear to be related in many cases to the actual density of the casting concerned. Occasionally, it was obvious that the heat-treatment was not all that could be desired—a circumstance which might be governed by the fact that a load of castings in the annealing furnace did not always receive the ideal treatment which the test results could have led one to expect.

Another too frequent source of extensive trouble was in cast-steel crankshafts and a number of failures had occurred over the past few years. On two occasions, the failure had been traced to sub-surface defects too near the outer skin of the casting. In three instances, failure had been associated with welding repairs, and in at least one of these it had to be reported with regret that no post-welding heat-treatment had been carried out.

After quoting a number of similar examples, Dr. Dorey continued by stressing that while great care must be taken in the production of all-important castings, certain series, particularly those subject to pressure in service or to dynamic loading, should have extreme care at every stage of manufacture.

Challenge to the Skill of Founders

It should be remembered, he concluded, that the aim of every steelfounder was to produce an article as near perfection as he could make it Admittedly, this was a difficult task, but if it was looked upon as a challenge to the skill of the people concerned, it was certain that in many cases much better could be done than was done, at least in some foundries at present. It had to be said that there were foundries which were content to produce a mould and run the casting, and whatever the result, assume that permission to repair would be given, even if the repair was finally to become a high percentage of the original casting volume. When it was considered that as a result of defects, hitherto undetected, a ship might be held up for a month for the replacement of a particular part and a loss of earnings be incurred of from £30 to £50,000, it would be realized that the problem could assume alarming dimensions. A good surveyor could be a friend to the founder, purchaser and user alike. Knowledge and experience taught him the difficulties to be met with in the making of a good casting, but the same factors taught him also that thousands of excellent castings were made every week. In realizing the difficulties, he was prepared to help the foundry at all stages and in the event of defects being revealed, would treat them individually on their merits and supervise the necessary repair and subsequent treatment, thus ensuring, as far as was possible, that the casting was fit for the service intended.

Welding Requirements

In the discussion which followed, Dr. Dorey's paper, it was again made abundantly clear that the steelfounders were determined to profit from criticism of their welding procedures for the rectification of blemishes, as one founder put it to his colleagues, in effect, "Let us organize this business of welding properly, there is too much indiscriminate and too casual application of welding to our castings."

Other comments included a statement from Mr. Annis as to the possibilities of "paste pickling" of large and awkwardly-shaped castings for which no bath was available. His company, he said, was prepared to co-operate with founders in applying this method. Another founder whose business was concerned with a smaller type of casting asked how to tackle epidemics of defectives arising after prototypes had been approved—he was advised to pay attention to possible variations which had resulted in departures from what was the established practice. The ideal should be to formulate a successful procedure and then adhere to it; later, taking individual sample castings at random for testing.

Summing-up

To wind up the proceedings of the convention, Mr. Menzies gave a brief summation of what he thought were the main conclusions and lessons to be applied as a result of the very frank and open discussions. Mainly, he observed, good agreement had been the rule. The following were his chief points:—

(1) *Welding.*—He would like to feel this was now regarded as part and parcel of normal steelfounding

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processes. It was time it was brought out into the open and optimum welding procedures were adopted in foundries.

(2) *Fabrication* v. *Casting.*—Here, founders always seemed to get the "awkward squad," but this of course was their business and they were getting better and better qualified to tackle difficult jobs.

(3) *Rough Machining and Pressure Testing.*—It was not possible to generalize on these matters; pressure testing seemed satisfactory in some cases and useless in others. A machine-shop did not appear to be essential to a steelfounder, who in a case of necessity could often make use of machining facilities available locally.

(4) *Arc/Air Tool.*—The application of this process for defect removal was a useful tool when applied with discretion and skill, but he agreed that proper crack-detection afterwards could not easily be carried out.

(5) *Customer/Founder Co-operation.*—Its value was well proven by the present convention, which was an improvement on that held earlier because that had been in the nature of an "inquest" where "diagnosis" would have been preferable. Still more collaboration was needed and steelfounders would take the initiative in this, but they still required more information to be passed back from customers.

Vote of Thanks

Mr. F. Rowe (managing director, K. & L. Steelfounders & Engineers, Limited) then proposed a vote of thanks be accorded to Mr. Menzies for his able chairmanship. As a steelfounder, he said, he was very gratified with the new feeling displayed in contrast to the previous convention, where founders were "in the dock." Keen competition on quality was infinitely to be preferred to competition on price. He feared that if the latter came again to the British steelfoundry industry, co-operation on research and all the good things which could stem from it would "go by the board" and this really would be a situation to be deprecated and fought against. Price should not be the criterion against which a steel casting was measured—only suitability for the functional purpose could fairly be applied as a yardstick.

Mr. R. C. Bond (British Transport Commission) seconded the proposition which was carried with applause, and Mr. Menzies, after acknowledging, closed the meeting.

Machine-tool Order Book

Orders in hand for machine tools are worth £104,560,000—nearly 16 months' production at the average rate for the first eight months of the year. Over the past eight months, deliveries at £53,200,000 value were 10 per cent. higher than in the similar period of 1955. The high production achieved by the machine-tool industry in July indicates that a rate substantially above that for the first eight months will be recorded for the end of 1956.

New orders for machine tools in August were the lowest for any month since December, 1954. Orders for UK customers, £5,570,000 in July, dropped to £4,500,000 in August. Total orders at £6,370,000 were £1,500,000 less than for August, 1955. The export order-book stands at £22,970,000 and the value of exports from January to October this year is £19,170,000, a rise of nearly 11 per cent. over last year. The rate of import remains high. In the first 10 months, tools worth £20,320,000 were imported, nearly 50 per cent. more than for the same period in 1955.

Iscor's Steel Output and Sales Up

Dr. F. Meyer, chairman of the Iron & Steel Corporation of South Africa, Limited, speaking at the annual meeting, said that the corporation's ingot production rose by 46,000 tons to 1,465,000 tons, while steel sales, at 1,139,000 tons, were up by 63,000 tons. The value of sales was £43,000,000. South African consumption was 43,000 tons up at 1,578,000 tons, the balance of 439,000 tons being imported.

Ingot capacity is to be raised to 2,000,000 tons. This will be attained by extensions at Pretoria and Vanderbijl Park, but any further major extension can be made only at Vanderbijl Park or at a new third steelworks.

Iscor's trading surplus was about £1,000,000 higher at £12,200,000. In view of the increased interest rates the State's dividend will be 6 per cent. This rate was paid until 1947, since when it has been reduced to 4½ per cent. for the eight years ended June, 1955.

Import Duties on Ferro-Manganese and Iron and Steel Products

Under the Import Duties (Exemptions) (No. 11) Order, 1955, and (No. 8) Order, 1956, the import duties on a wide range of iron and steel products are suspended until March 18, 1957. After consultation with the Iron and Steel Board about the supply position, the Government has decided to prolong until September 18, 1957, this suspension of import duty on the same range of products, with the exception of tinplate and terneplate, upon which duty is to be restored after March 18, 1957.

In order to ensure adequate supplies, the Government has also decided to prolong for a further six months until September 18, 1957, the present suspension of duty on blast-furnace ferro-manganese and colliery roof-support arches.

Accordingly a new Order, the Import Duties (Exemptions) (No. 15) Order, 1956 (SI 1863), has been made and will come into operation on March 19, 1957.

Nearly 2,000,000 Working Days Lost in 10 Months

Industrial stoppages lost the country 190,000 working days during October—according to the *Ministry of Labour Gazette.* This was 30,000 less than in September, but 4,000 more than in October, 1955. The main strikes contributing to the total were those in the Yorkshire coalfield, at A. V. Roe & Company, Limited, and at Harland & Wolff, Limited. Nearly 2,000,000 working days were lost in the first 10 months of the year, compared with 3,380,000 for the similar period of last year.

There were 139,520 unfilled vacancies for men, of which 15,386 were in engineering and shipbuilding and repairing.

The index of wage rates remained steady at 165 (June 1947=100). In the first 10 months of 1956 just over 12,000,000 workers received increases in wage rates totalling £317,000,000 a year.

Development of Hot-blast Cupola Melting Technique in Europe*

By E. L. W. Löbbecke

[ABRIDGED]

(*Continued from page 666*)

Operating Experience

Fig. 12 shows the course of events on the first day of operation of a hot-blast cupola plant for the production of automobile castings with a melting rate of approximately 12 tons per hour. When placing the order the customer required: (1) a metal temperature at the pouring point of 1,420 deg. C.; (2) to use as large a quantity as possible of cheap charging materials, particularly steel scrap; (3) a maximum limit of 0.10 per cent. in deviations in the carbon and silicon contents, and (4) pearlitic structure in the cast product, and no detrimental effect on machinability through surface chill or excessive hardness at the corners.

In anticipation of the expected metallurgical behaviour of the cupola, preliminary calculations were made, before putting the plant into operation. The first coke charge, the composition of the metal charge and the amount of fluxes to start with were determined from these calculations. With increasing blast temperatures the latter were then to be adapted to the metallurgical alterations in the melting process. The result was the course of events logged in Fig. 12. The entire system was still somewhat damp, of course, and hence, temperature was increased very slowly but steadily to the guaranteed temperature of 450 deg. C. and was then kept at approximately 470 deg. C. The carbon content had reached the upper limit of the required analysis after about 70 min. and was kept within the set limits without difficulty. With the silicon it was somewhat more difficult to get the required tolerance, but this was also accomplished after about 1½ hr.; silicon contents could then also be kept within the limits of 0.10 per cent. This meant that with regard to the composition the user's requirements were met within a few hours after the start of operations.

It is interesting to see how melting behaviour of the cupola followed the principles which have been described earlier. It is apparent that at about 10.30 a.m. the silicon content was at the lower permissible limit. In view of the structure desired it appeared necessary, however, to raise the silicon content to somewhere near the upper limit. An addition of ferro-silicon was to be avoided, so as not to lose the economic advantages over the cold-blast operation already achieved. The percentage of steel scrap in the charge, which had been 8 per cent. with cold blast, was therefore increased to 37 per cent., at the same time the addition of limestone was reduced and the coke charge slightly raised again. Metallurgically these measures altered the concentration relations in the cupola. The increase in the percentage of coke ash and the simultaneous reduction of the CaO proportion in the form of limestone increased the concentration of SiO_2 in the slag, *i.e.* it became more acid. On the other hand, the increase in the percentage of steel scrap in the charge meant a reduction of the silicon concentration in the metal. Therefore, conditions for a reduction of silicon from the slag were bound to become more favourable, more so as with the same blast temperature the increase in the coke charge led to an increase in the metal temperature (see Fig. 3) and to a decrease in the combustion ratio η_V. The steps taken were confirmed to be correct by the rise in the silicon curve. The carbon contents hardly changed, because the carbon pick-up was obviously checked by the reduction in basicity of the slag. The reason for the fact that at about 12 noon the carbon exceeded the upper limit in the analysis was that the cupola crew had put in an extra charge of coke from sheer habit; this had not been asked for and, therefore, could not be balanced.

At any rate, the example shows that it has, in fact, become possible to control and steer the melting procedure in a hot-blast cupola, even when—as in this particular case—the cupola in question is fully lined, which means that the lining erosion, which cannot possibly be calculated in advance, brings in a factor of uncertainty. The metal produced met the requirements as to microstructure and there were no differences found in machinability. Fig. 13 shows the metallurgical course of events during the start of operations of a 12-ton per hour hot-blast cupola plant at Crane Limited, Ipswich. This unit was to produce blackheart malleable iron from the cheapest possible charging materials. The alteration in the additions of ferro-alloys which were made during this first melt are apparent from the upper part of the illustration. Of particular interest in this connection are the smaller ferro-manganese additions, made possible by the lower manganese melting losses in the hot-blast cupola, despite acid slag, and the complete elimination of ferro-silicon additions after six hours of melting.

The middle section of Fig. 13 shows that there was a reduction in the percentage of pig-iron in the charge, from 14 to 5 per cent., and at the same time an increase in the steel scrap charge to 32 per cent. The savings in costs, compared with cold-blast operation, which were brought about by

* Paper read before the American Foundrymen's Society. The Author is on the staff of Strico GmbH, Gummersbach, Western Germany. Recently, Mr. Löbbecke read a paper with a similar coverage before the Birmingham branch of the Institute of British Foundrymen (see page 702 of this issue).

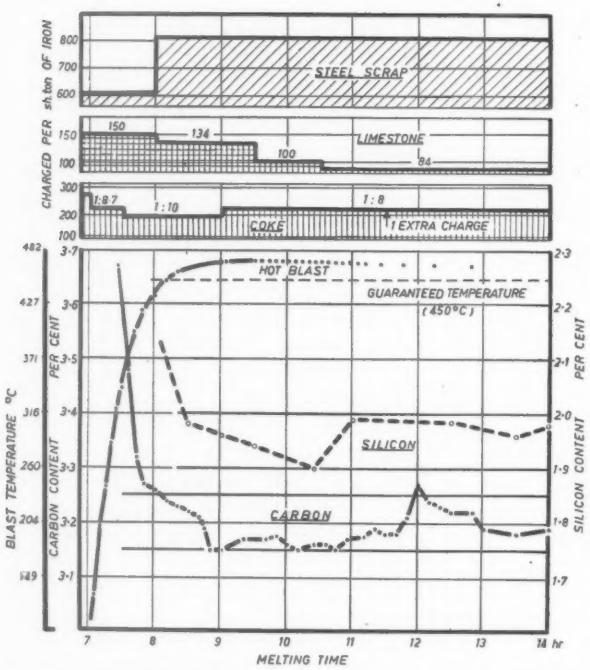

FIG. 12.—*Starting up of a 12-ton per hour hot-blast cupola melting unit for automobile castings*

these measures are illustrated in the lower part of Fig. 13. At the end of first day's operation a saving of $4.22 (28s.) per ton of liquid metal had been achieved merely through the alteration in the metal charge. Further savings have been obtained in the meantime so that due to additional gains the installation will pay for itself within an unexpectedly short period.

Metallurgically, these economic advantages could be obtained only if with the utilization of all possibilities the cupola was expressly operated in the direction of silicon pick-up from the slag. Fig. 14 shows the success of these endeavours. When all the steps had been taken, the carbon and silicon contents of the metal were only slightly different from the desired analyses. To do all this it was, of course, absolutely necessary to keep the hot-blast temperature at an even level so that undesired changes in the thermal, and consequently metallurgical, conditions within the cupola would be ruled out and that it would be necessary only to alter the concentration factors. Fig. 15, which concerns the same plant, shows that this result was not brought about by coincidence but can be reproduced at will. For reasons of comparison, there are shown in the upper part of Fig. 15 the metallurgical data of the last week that the cupola was run on cold blast, and below this are data for melting days when the same cupola was operated on hot blast. Particularly apparent are the carbon pick-up, which is twice as high in the hot-blast cupola, and especially the silicon pick-up, in contrast to a considerable silicon loss in the cold-blast cupola. With regard to manganese, the reduced melting losses in hot-blast cupola operation are not clearly visible in Fig. 15 because melting losses and gains are expressed here in per cent. of the compositions of the charge.

However, with cold-blast operation the melting loss of approximately 30 per cent. was related to a charge of 15 lb. ferro-manganese per ton, and in Fig. 16 the same per cent. melting loss with hot blast is related to only 3.2 lb. ferro-manganese per ton, and at the same time the total of manganese brought into the cupola through the steel scrap and pig-iron is reduced, thus this illustration also represents a saving in manganese. Incidentally, this form of illustration of the melting procedure in the hot-blast cupola clearly shows the correlation between silicon and manganese; higher silicon pick-up is connected with higher manganese melting losses, and *vice versa*.

The blackheart malleable iron produced in this hot-blast cupola did not show any differences in its microstructure when compared to the previous cold-blast cupola iron. Neither were there any differences found during heat-treatment and machining.

Poor-quality Coke

The fact that the metallurgical proceedings in the hot-blast cupola can be guided and controlled also facilitates the use of lower-quality fuels without detrimental effect on metal quality. In a special test series it was, therefore, investigated under what conditions an iron for use in automobile castings could be produced in an acid-lined hot-blast cupola with the use of only soft, high-ash coke. The coke taken for these experiments had C_{fix}, 77.3; sulphur, 1.2; ash, 19.4 per cent.; calorific value H_u 6.398 kg. cal. per kg. coke. The screen test showed 83 per cent. over 1.57 to 2.36 in., shatter test 62.8 per cent.

In one series of test runs, the metal charge consisted of 40 per cent. pig-iron, 40 per cent. bought cast-iron scrap and 20 per cent. return scrap, in another series it was 40 per cent. pig-iron, 30 per cent. steel scrap, 10 per cent. bought cast-scrap and 20 per cent. shop returns. The cupola had a 24-in. inside diameter and was operated with hot blast of 450 deg. C.; tapping was done continuously through a siphon.

As a preliminary result of these experiments, which are still to be continued, it can be stated that it is possible to produce good quality automobile castings under these conditions. With the same blast-volume and hot-blast temperature that would normally be used with high-grade foundry coke, the melting rate is somewhat lower, in fact, actually somewhat lower than would be expected from the low carbon-content of the coke.

Fig. 16 shows a few average values that have been established in comparison with the melting rates that are normally encountered in the same hot-blast cupola using normal foundry coke. The blast pressure that was required was remarkably high. There was a fan blower to produce the blast, and it was difficult to introduce the volume of blast quickly enough into the cupola to sustain fast combustion. For such types of readily caking coke it seems to be advisable, therefore, to operate the cupola with a positive blower like a Root's blower, which contains sufficient margin to overcome such cupola troubles as sticking, hanging, or bridging. Analysis of the metal at the spout was held within close limits, after comparatively large initial fluctuations in the silicon contents had been overcome.

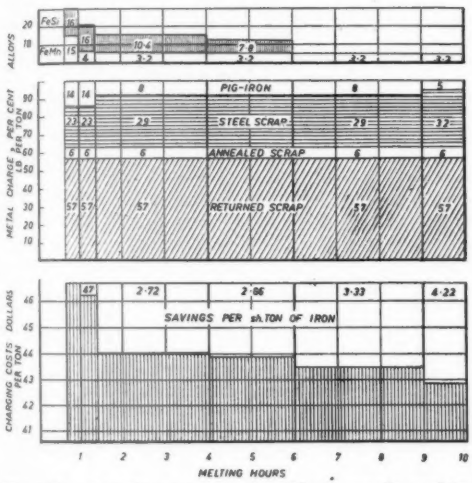

FIG. 13.—*Starting up of a hot-blast cupola melting unit to operate on an economic charge for the production of blackheart maleable iron. 50 dollars per short ton = approximately £20 per long ton.*

Iron temperatures fell in line with the applied conditions.

The iron foundry hot-blast cupola operated with basic or neutral lining has not yet been accepted in Europe. Its application will probably remain limited to certain brands of high-quality cast-iron, because the inherently more expensive lining costs have to be compensated by a correspondingly high selling price of the finished product. Experiments made by E. S. Renshaw[4] have become generally known in the meantime and have frequently been discussed. The same applied to the work by E. Piwowarsky and H. Schmidt who made comparative investigations with acid and basic slag at the Aachen Foundry Institute. Following that series of experiments H. Schmidt then compared the costs of basic melting with those of acid melting, both on the basis of German raw-material prices, and he arrived at the conclusion just mentioned.

A recent publication by W. Heinrichs on the practical experience of operating a hot-blast cupola lined with carbon gives some theoretical considerations, but in addition this unfortunately limits itself primarily to discussing the composition of the slag used. The cupola was run at Krupp, Essen, with basic slag. More informative is an investigational report which was given at the 21st International Foundry Congress 1954, at Florence, by the Italian experts C. Bortolani, W. Demicheli and C. Longaretti. This report is concerned with the production of cast iron for ingot moulds from a basic-lined hot-blast cupola. Wtih a basicity of 1.8 average and varying percentages of steel scrap in the charge they obtained the carbon contents shown in Table II. The metal from the basic cupola was well suited to

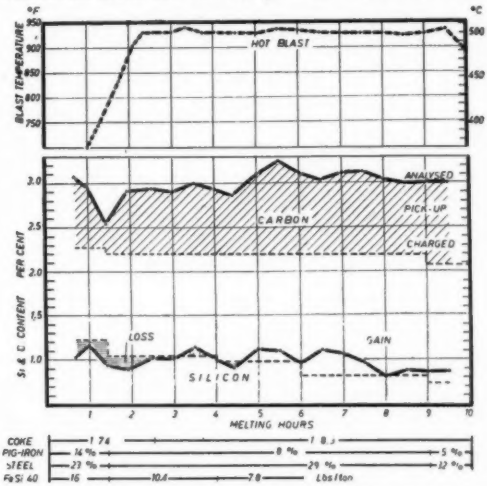

FIG. 14.—*Actual silicon pick-up in the production of blackheart malleable iron.*

the production of ingot moulds and had at least the same quality as the metal from the acid-lined cupola.

TABLE II.—*Influence of Percentage of Steel Scrap in the Charge on Carbon Pick-up in a Hot-blast Cupola.*

Steel scrap, per cent.	Carbon content, per cent.
Basic-lined cupola	
40	4.13
65	3.79
100	3.52
Same cupola, acid-lined.	
30	3.68
50	3.63

In continuation of the Piwowarsky investigations of the basic hot-blast cupola, M. G. Frohberg and W. Döbber found that coating the coke, which for a long time held promise as a means to lowering the carbon dioxide reduction, did not effect an increase in the tapping temperature of the metal.

Hot-blast Cupola with Cooled Melting Zone, without Lining

Particular attention has been paid during the last year or so to the hot-blast cupola with cooled

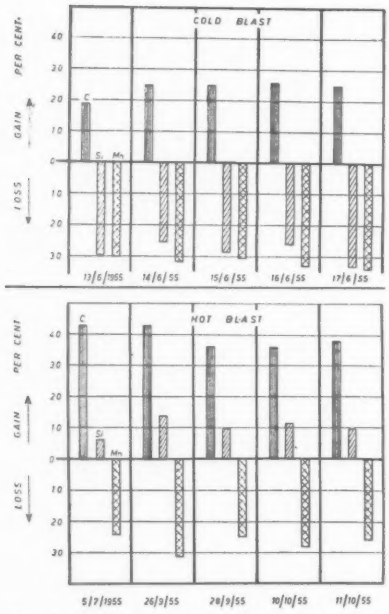

FIG. 15.—*Melting behaviour of a cupola with cold-blast operation and with controlled operation on hot-blast.*

melting zone without lining. As has been mentioned earlier, there are at present three fully automatically-controlled hot-blast cupola installations of this system in operation, two in Great Britain using outside spray cooling and one in Germany with pressure cooling. Results that have been compiled are not as yet extensive enough to allow scientically sound conclusions. These are to be the subject of further reports at a later date.*

[* The Author at this point continues by quoting a number of thermal-balance equations mentioning also a number of factors which so far have not been properly resolved, as well as practical results which have deviated from those expected from theoretical studies. He mentions that on the basis of their first operating experience, Dobson & Barlow, Limited, have stopped charging pig-iron in their cupola plant (with cold-blast operation, the percentage of pig-iron in the charge was 25 per cent.) and are instead charging only cast-iron scrap, return scrap and steel scrap. Utilization of all the metallurgical possibilities available in this new melting unit has not only kept the quality of the metal at a uniform level, but has actually improved it by two grades in British Standards. This is reflected in an increase in tensile strength from 12 tons per sq. in. to 14 tons per sq. in. and in considerably less trouble from varying wall-thicknesses in the casting, along with improved castability.

Finally, reviews are included of the possibilities of using a special cupola as a pre-melting unit for steelworks and, briefly, of the incorporation of ore as a small or major portion of the charge in such a furnace.—EDITOR.]

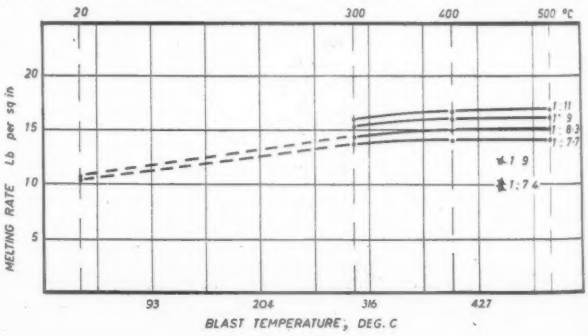

FIG. 16.—*Influence of the quality of the coke on the melting rate of a hot-blast cupola.*

Summary and Conclusion

It has been endeavoured to present a general survey of the development of hot-blast cupola melting techniques in Europe, and particular reference was made to the metallurgical and thermo-technical problems which have primarily influenced this development. Starting from fundamental metallurgical research and the requirements that follow from them and that have to be demanded of a modern hot-blast cupola plant, it was shown by way of example with one melting furnace system, to what extent these requirements can be met at the present stage of development.

Operating experience gathered both from hot-blast cupolas with lining and also without lining in the melting zone has shown that melting units can be controlled and regulated and have to be considered valuable metallurgical furnaces. Illustration of the metallurgical research work also furnishes a reply to a question which crops up time and again, namely: "Why is it that hot-blast cupolas in Europe use such high blast temperatures?" Not to save coke, but to make use, to the widest possible extent, of these metallurgical advantages which only come into full play with the use of higher blast temperatures in the cupola!

The design and construction of the European hot-blast cupola plants has no doubt become more complicated, but this does not apply to their operation, due to the use of automatic controls and similar means. The modern hot-blast cupola with blast temperatures of over 400 deg. C. may require more care and scientific metallurgical observation than its modest brother operating on cold blast.

However, this attention pays by giving maximum efficiency in quality and economics. The original crude remelting furnace of the ironfoundry has to-day grown up into a valuable metallurgical melting furnace which is continuously widening its application and makes its way into fields which could not possibly have been considered even only a few years ago.

Acknowledgment

It is a pleasant duty to express thanks to all who have so kindly assisted in this report, especially the Buderus'sche Eisenwerke in Germany, the International Research Group for the Hot-blast Cupola,

Textile Machinery Makers, Limited, and Crane, Limited, in Great Britain, and last, but by no means least, Dr. A. E. Schuh, of U.S. Pipe and Foundry Company, USA, at whose instigation this report was written and whose many helpful suggestions and critical review of the manuscript are deeply appreciated.

REFERENCE*

[1] FOUNDRY TRADE JOURNAL, **80**, 149. Renshaw, E. S., and Sargood, S. J.: FOUNDRY TRADE JOURNAL, **97**, 449. *Foundry*, 79, 82-85, 193, 196, 199.

* Selected from a list of 57 included by the Author—Editor.

The Steelmaker and Power Generation

Steel and power were the main themes of the fifth Dorman Long Harold Wright Lecture delivered to the Cleveland Scientific and Technical Institution on November 29 by Dr. Charles Sykes, deputy chairman and managing director of Thos. Firth & John Brown, Limited, Sheffield.

In his lecture, which was entitled "The Special Steel Maker and Power Generation," Dr. Sykes referred to the need for more power per craftsman to increase his productivity and improve his working conditions.

As a country, he said, we were short of fuel and must, therefore, develop our power with the greatest possible economy. The improvement in average efficiency of electricity power generation had been brought about as a result of the marked progressive increase in the efficiency of the turbines installed during the last decade.

Dr. Sykes said that since 1947 the fuel consumption per unit of power as designed had decreased by 21 per cent., steam temperature had been increased from 850 deg. F. to 1,050 deg. F., the pressure from 600 lb. per sq. in. to 2,350 lb. per sq. in., and the unit size from 30 mw to 200 mw.

"These changes have involved the use of a number of special steels and have introduced a number of metallurgical problems," said Dr. Sykes. "Research into the creep strength of steels has made a major contribution to developments in power generation." A number of the materials developed for the jet engine and gas turbine projects had already been absorbed into steam turbine practice and more would follow as operating temperatures rose.

Outstanding engineering developments had taken place in turbo-alternator design since 1947. The special steel maker had been able to assist in some parts of this development. There was, of course, a number of unsolved problems and new problems would arise as the turbine designer continued his pursuit of higher efficiency in power generation, said Dr. Sykes.

"The policy of forward planning adopted by the Central Electricity Authority and the close collaboration which exists between the turbine builders and the special steel makers are of great assistance in enabling research and development on these problems to be started at an early age."

THE Stanton Ironworks Company, Limited, near Nottingham, has received an order from the Mid-Northamptonshire Water Board for 9,200 yds. of 36-in. diameter pre-stressed concrete pressure pipes and specials with lock joints for a raw water main from Duston Mill to Pitsford. The total value of the contract is £117,000 and it is expected that delivery will be completed in February, 1958.

Margam Development Scheme

"One of the highest production units in the world" was the phrase used by Mr. W. F. Cartwright to describe the Steel Company of Wales, Limited's, Abbey Works at Margam, Port Talbot, when the proposed £50,000,000 development scheme is completed. Mr. Cartwright, who is general manager and assistant managing director of the company, was speaking to the Publicity Club of Cardiff on December 4. When the scheme is finished, the company would be producing a complete range from ¾-in. steel plate to the thinnest tinplate in the world's most modern plant, he said. The Margam project was started in 1947 when 4,000 people were employed. When the latest scheme was finished there would be between 14,000 and 15,000 employed there. The plant would be producing 40,000 tons of pig-iron weekly, 60,000 tons of ingots, and making 30,000 tons of coke from the 45,000 tons of coal used.

Imports of foreign ore would be increased to 60,000 tons a week, and the coal would come from nearly 50 different South Wales collieries. The scheme involved the construction of a giant blast furnace and other plant, and a modified form of the basic Bessemer process—the oxygen-steam technique—for making steel ingots would be employed.

Referring to a world shortage of steel plates, Mr. Cartwright said that the company's plant was laid out so that it was "reasonably flexible." The present "dip" in the car industry would enable the company to divert some tonnage of car sheets to light steel plates which were in desperately short supply.

Engineering Exports Competition

In a broad survey of the export position of various sectors of the engineering industry the Engineering and Allied Employers' National Federation emphasizes that the picture reveals danger signals which cannot be ignored. The survey states that export orders in electrical engineering are falling and, despite some small rises in output, margins have been shrinking. Exports of diesel engines during 1954 and 1955 fell considerably compared with those of Germany and the United States, while the flow of new export orders for locomotives and rolling stock recently has been disappointing. In addition to European countries and Japan, the latter industry now faces competition from behind the Iron Curtain, where prices are some 30 per cent. below ours. Orders are being taken by UK manufacturers at low firm prices and with guaranteed deliveries under penalty in order to maintain a foothold in traditional markets.

While the overseas demand for machine tools remains good, competition is growing, and German exports rose by 18.8 per cent. in the first half of this year, while Czechoslovakia is now the world's fourth largest exporter of machine tools. Referring to textile machinery, the survey points out that about 70 per cent. of output goes for export, and the market is now extremely competitive, Germany and Switzerland being the main competitors. Increasing competition in marine engineering is coming from the United States, Germany, Italy, and Holland.

In the boilers, tanks, and gasholders sector, the federation pointed out that the industry has lost to the US and Continental competition valuable orders in India, the Far East, the Middle East, and in Europe.

GENERAL ENGINEERING COMPANY (RADCLIFFE), LIMITED—Mr. Thomas P. Whitworth has been elected to the board.

Notes from the Branches

Birmingham

The November meeting of the Birmingham branch of the Institute of British Foundrymen was held at the James Watt Memorial Institute on November 28. Mr. T. H. Weaver, branch president, was in the Chair and a paper was presented by Mr. E. Löbbecke, chief metallurgist of Strico, Limited, Gummersbach, Western Germany. His title was "From Lined Cold-blast Cupola to Hot-blast Liningless Cupola." Mr. Weaver, in introducing Mr. Löbbecke, thanked Mr. Driscoll and Mr. Grant (of Cupodel, Limited) for making the arrangements for the lecturer to come at short notice, in place of Mr. D. Fleming who had unfortunately been unable to present his paper to the branch.

Mr. Löbbecke commenced by saying that melting in hot-blast cupolas was now an accepted method, and was based on the same thermal and chemical reactions as occurred in cold-blast cupolas. He went on to state that the modern hot-blast cupola had a cooled shell with no lining in the melting zone, and next outlined the various factors which influence the operation of these furnaces. In a survey of operating experiences, he indicated possible economies, but added that experience on larger plant was disappointing at first. Later, it was found that the blast velocity and tuyere angles were critical, and when these are adjusted to suit the individual hot-blast cupola, it can be operated with stability and at a high temperature. Mr. Löbbecke concluded by saying that a number of hot-blast cupolas were now operating continuously without any lining at all in the melting zone and producing high-quality iron from the cheapest possible materials, under extremely economical conditions.

Mr. H. G. Hall, in proposing the vote of thanks to Mr. Löbbecke, said he first met him about 18 months ago when he formed the opinion then that his experience of operating hot-blast cupolas was extremely wide. The possibilities of hot-blast cupolas seemed to be enormous and that there was no comparison between the conventional cold-blast cupola and one utilizing hot blast.

MR. R. T. HIGGINS (of the British Cast Iron Research Association) seconded the vote of thanks and after a lively discussion, the meeting concluded. It was felt by members of the branch that the evening had proved both interesting and stimulating.

Works Visit

By courtesy of Dr. J. G. Pearce, approximately 20 members of the branch, headed by Mr. T. H. Weaver, the president, visited the BCIRA on Wednesday afternoon, November 7. Dr. Angus, acting for Dr. Pearce, welcomed the members and they were then split up into several parties and proceeded to visit the various departments.

First came the sand laboratories where research was being done on scabbing, using specimens heated dielectrically. Members next proceeded to the gas laboratories where the apparatus for measuring oxygen, hydrogen and nitrogen in cast metal samples was seen. After visiting the old melting shop, and inspecting the progress of the new melting shop, the parties also visited the chemical laboratories.

Tea was kindly provided by the Association in the canteen and afterwards Mr. Weaver thanked Dr. Pearce and the Council for the hospitality and kindness shown to the party. He also thanked those who had been responsible for arranging the visit, including Dr. Angus, and concluded by emphasizing the importance to the industry of the sort of scientific research carried on by the Association.

In reply, Dr. Angus said that sometimes the problems might seem to be academic but in actual fact all work being done at the laboratories was of positive interest to foundrymen.

Coventry

On Tuesday, November 13, the Coventry and district section held their second meeting of the session at the Coventry Technical College, when Mr. G. J. Rogers presented a paper entitled "Founding Principles, their Application to all Metals." Mr. Rogers proved himself to be well qualified to speak on this subject and drew on his wide experience to illustrate the main theme of his paper, namely progressive, directional solidification. The paper was well received by all present and an interesting discussion followed. Mr. D. R. Fardoe, the section president, was in the chair. (Mr. Rogers's Paper was printed in the FOUNDRY TRADE JOURNAL, May 19, 1955.)

Australia (Victoria)

The October meeting of the Australia (Victoria) branch heard a lecture by Mr. J. Caine B.A. on "Automation." Mr. Caine is the officer in charge of occupational research, at the Department of Labour and National Service (Australia). The Paper made special reference to the application and effects of automation upon the foundry industry.

Steel and the Fuel-Oil Shortage

The steel industry would be among industries which would be most affected by the 10 per cent. cut in the supplies of fuel oil to industry, said Mr. W. B. Wells, the East and West Ridings Regional Controller for the Ministry of Fuel and Power, at Leeds on December 4.

He said that the cuts had been made after a very close assessment of available supplies, and it was unlikely there would be any lessening in the cuts. He added, "Any industrialist who is badly affected should refer to the sponsoring department—some would come under the Board of Trade, and others under Government departments such as the Admiralty, Ministry of Agriculture, Ministry of Works, etc.—and the case would be investigated. Certain machinery had been set up to deal with exceptionally hard cases." Telling the meeting that there was very little spare oil, he said it was hoped that industrialists would make the best possible use of other fuels such as coal-tar fuels.

NEARLY 30 MEMBER-FIRMS of Sheffield Chamber of Commerce and Manufacturers have responded to an appeal by their president Colonel C. R. Hodgson to peg prices.

LAST WEEK at 28, Brook Street, the West End showroom of Allied Ironfounders, Limited, a special show was staged showing the appliances they make specially for railway companies. Included were the "Valley," stove, a small apparatus suitable for foremen's huts on building sites and special locking and safety devices suitable for "Rayburn" and "Alicon" stoves when these are installed in waiting-rooms. Another useful exhibit was a seamless stainless-steel bucket suitable for canteens and laundries.

Influence of Rate of Solidification on Mechanical Properties of Cu/Sn/Zn and Cu/Sn/P Alloys*

Discussion of the French Exchange Paper by P. J. le Thomas and D. Arnaud

Theories concerning the effect of dissolved gases on segregation are discussed together with the effects of grain size and the use of grain refiners. The influence of gases on the amount and location of porosity and the design of test-pieces are also dealt with.

When the Paper was presented at the meeting by Mr. le Thomas in person, the Chairman (Mr. J. Blakiston) congratulated him on the clear presentation of a rather technical subject in what was to him a foreign language. The Paper, he said, covered a very involved subject and it had been prepared with a lot of care. Some of the magnifications of metal structures illustrated were very low, representing what the average person could see by the normal visual examination of fractures. Many years ago, before analytical methods had reached to-day's efficiency, founders' assessment of bronze castings had relied more or less on visual examination of the fractures, which had indicated immediately whether the metal was cast too hot or too cold and whether the finished component was likely to have the required strength.

DR. J. T. BERRY (Royal Naval Scientific Service, N.C.R.E., Dunfermline), in view of the many theories concerning the effect of dissolved gases on segregation, asked for Mr. le Thomas's personal view of the rôle of these gases and whether they merited further study. One could not see that he had actually degassed the material used in his test-bars. Did he feel that gassing and possibly over-gassing, would further complicate the study from the point of view that it affected the segregation?

MR. LE THOMAS said that in the particular study discussed in the Paper, the Authors had not taken into account the effects of dissolved gases; they had endeavoured to pursue their study with metals which were absolutely free from all gas. It had been proved that dissolved gases had a definite influence on segregation. The presence or absence of tin "sweat" showed this up clearly; when bronze has been well degassed, it was quite rare to find buttons of an alloy rich in tin in the feeder heads on the casting. The chemical composition of this tin "sweat" was also of significance. It comprised the peritectic phase which by decomposition gave rise to the delta constituent. The Authors had been able, during the course of other tests, to show that the tin buttons represented the peritectic phases. Some bronzes containing 8 to 12 per cent. tin had been prepared with increasing percentages of phosphorus (up to 3 per cent.) and small cylinders of substantial section were cast of these in core sand, in such a manner as to favour the formation of "sweat" exudations. After solidification, the latter were detached and analysed separately. The compositions obtained corresponded exactly with the peritectic line of the diagram, that is, the eutectic line of the ternary copper/tin/phosphorus diagram. The presence of gas was not essential for the segregation of the delta phase to take place, but it did complicate such studies. In the light of existing knowledge, the Authors preferred not to comment on the effect of dissolved gas.

DR. BERRY said: "You feel that gas played no part?"

MR. LE THOMAS said that in the particular case of their experiments, the Authors believed that the effect of gases had not played an important part. Every time a test-piece was suspected of being gassy, it was discarded and the test restarted. No special technique of degassing was used but keeping always to the same conditions of the test minimized the effect of gassing. The 17-lb. furnace used (heated by propane gas), produced an extremely oxidizing atmosphere. The metallic charges were carefully decreased with trichlorethylene. Only virgin metals were used and pieces of cathodes were specially selected. The Authors had no confidence that with bronzes less free from gas, results would be identical. They retained their own views on this subject but, without further experiments, preferred not to comment further. However, the question posed by Dr. Berry merited special study.

Alloys with 8 per cent. Tin

MR. H. G. HALL said he was not very clear in his mind about Fig. 11 of the Paper, where the Authors gave the true stress of 2 per cent. zinc bronzes as a solid line with a high point at 8 per cent. tin, whereas the experimental results for specimens A and B showed a marked drop at that particular point. Could Mr. le Thomas give a little more explanation of the true-stress line with regard to the 8 per cent. tin?

MR. LE THOMAS said that the broken lines of Fig. 11 were based on experimental results. The full line related to the result of the correction for grain size carried out systematically on all the test-pieces. It had been found that it was 8 per cent. tin bronzes that gave the largest grain-size, and thus this group benefited the most from the correction.

MR. HALL said the graph suggested that the 8 per cent. tin alloy was the most difficult of all from the point of view of obtaining uniform results—was that so?

* Paper presented at the Cardiff conference of the Institute of British Foundrymen and published in the FOUNDRY TRADE JOURNAL, July 12, 1956.

Properties of Cu/Sn/Zn and Cu/Sn/P Alloys—Discussion

MR. LE THOMAS thought that the poor properties shown by these bronzes in this particular case were fortuitous. The 8 per cent. bronzes were not alone in showing large grain-size; it had been the same with bronzes with 5, 7 and 11 per cent., but, possibly, to a lesser extent.

Effect of Grain Size

MR. A. CIBULA (British Non-Ferrous Metals Research Association) asked if the Authors had considered the possibility of studying the effects of grain size on the proportion of δ phase by using grain-refining additions and thus varying the grain size without having to vary the rate of cooling.

MR. LE THOMAS replied that the Authors had not used grain refiners although without having studied the question in detail, he thought the use of grain refiners might be the solution to the problem. They too had carried out some tests on grain refining consequent upon British work on this subject, but up to that time, they had not visualized using the dilatometric method of testing for the delta constituent in these alloys, which prevented their giving a direct reply to Mr. Cibula. As a matter of interest, Mr. le Thomas pointed out that Mr. Cirou had obtained some interesting results with a novel method of grain refining. The bronze was cast through a sieve, beneath which was placed the nozzle of a compressed-air line blowing a light blast of air on the streamlets of liquid metal during the whole of the cast. In every case, considerable grain refinement was obtained, seemingly because of the multiplication of the number of nuclei and their excellent dispersion. The mechanical properties, however, were very variable and it was not possible to obtain good results consistently, doubtless because the control of the air output left much to be desired. It would seem to the Authors that grain refiners, generally speaking, reduced the quality of the castings by giving rise to microporosity. On the other hand, from the point of view of the wear resistance, it was possible that grain refining, because of its effect on the distribution of the delta constituent, might be extremely interesting.

MR. CIBULA agreed that that might be so. Yet if the bearing properties of the alloy were more important in a particular application than the tensile properties, and if it could be shown that these properties improved with increasing proportion of δ phase, then it might be useful to refine the grain size, in spite of the consequent reduction of tensile properties, as the proportion of δ phase would thus be increased.

With regard to porosity, Mr. Cibula said it seemed to him to be inevitable that the mode of fracture of the bronze or gunmetal would depend on the amount of this defect and the way in which the voids were distributed—whether they were at the grain boundaries or within the dendrite arms inside the grains.

MR. LE THOMAS asked if Mr. Cibula was referring to porosity which was not due to gases.

MR. CIBULA said he was coming to the question of gas. Not only was it important because it influenced segregation, as had been pointed out, but it must also, of course, influence the amount and probably the location, of porosity.

MR. LE THOMAS replied that the influence of gas was as Mr. Cibula had said, but it probably had a tendency also to cause the "sweating" out of the tin from the structure; the tin tended to exude from the casting in the presence of gas. Nevertheless, he still considered that, before considering the influence of gas on the structure, the structure of the metal without any gas should be studied.

Possible Cause of Scatter

MR. CIBULA said the possibility remained that the scatter of the results presented by the Authors might have been due to variations in gas content.

MR. LE THOMAS agreed, but he considered that the study of the fractures was fundamental. The delta crystals were not broken during tensile testing in the case of phosphor-bronzes, as they were in phosphorus-free bronzes. This was independent of the presence of gas or microporosity. It was a question of the slipping of crystals on each other during the course of tensile testing which only came about when the grain boundary was weak.

If, as Mr. Cibula had said, fracture was related to the quantity of porosity present, whether in the grains or at the boundaries, it became necessary to imagine porosity was evenly dispersed at the crystal boundaries in the case of phosphor-bronzes and between the dendrites in the case of phosphorus-free bronzes. But definitely this was not so for correctly-fed components such as tensile test-pieces. In badly-fed areas presenting much porosity, as for example in the interior of castings, the fracture ran from one micropore to another, as had been suggested by Mr. Cibula. When the fracture of a runner of large diameter was examined, it was found that it was only the central zone that was of large grain and discoloured. This, to the Authors minds, corresponded to the method of fracture as suggested by Mr. Cibula. This mode of fracture did not appear to be compatible with the high mechanical strength of the well-fed areas, which yielded good elongation results.

Test-piece Design

MR. H. G. HALL, referring to the general scatter of the results, said the Authors had taken the tests at three test-piece positions, A, B and C. He asked if the majority of the test-pieces broke in the centre of the gauge-length, or if there was any tendency for one or other to fracture elsewhere.

MR. LE THOMAS said that most of the bars fractured in the gauge-length. A certain amount of adjustment of the design of the test-piece had been necessary. The standard cruciform test-piece had been used because the "wings" of this test-piece normally had a dense and homogeneous structure. However, the French cruciform test-pieces were generally cast vertically; when such bars were cast horizontally, it was necessary to place an ample riser at the top (at least 5-mm. dia.) without which the drawback pointed out by Mr. Hall resulted. As a result a considerable portion of test-pieces would break in the head remote from the pouring

point. The Authors had lost a number of test-pieces from this very cause.

MR. HALL commented that the test-pieces were of the cruciform standard frame type. He was not familiar with bronze-foundry practice in this country, and he asked if a similar test-piece was used here or whether those used by the Authors had been to a special design.

MR. LE THOMAS said it was a test-bar design used in France for all official inspection work.

MR. HALL said it appeared, therefore, that considerable experimental work had been done before it was decided to make the test-bar that way, and that the incorporation of a central core in the feeder was an essential part of the technique.

MR. LE THOMAS pointed out that generally speaking a filter with holes of controlled size was placed beneath the feeding head so as to ensure regular filling, and above all a low speed. A sketch of this design had been given in *Fonderie*. As Mr. Hall presumed, these feeding systems had been given considerable attention before they were perfected. When using them for a 90/8/2 gunmetal, a breaking stress of 30 to 35 kg. per sq. mm. (equivalent to 19 to 22 tons per sq. in.) was obtained. To fulfil the requirements of the test there must be a difference in the rate of solidification between two bars of the same test-piece. This had led to its being cast horizontally. The exothermic pencil placed in the upper part of the feeding head, was not an absolute necessity. However, on examining some feeding heads at random, it appeared that the latter did result in a characteristic cavity at the extremity of the core.

MR. J. L. FRANCIS asked whether the test-pieces were cast in green- or dry-sand moulds. His reason for asking the question was that the rate or speed of cooling would have some effect on the amount of δ constituent formed.

MR. LE THOMAS said that the moulds were made in dry-sand so as to accentuate the difference between sand- and chill-cast specimens.

THE CHAIRMAN expressed the thanks of the meeting to Mr. le Thomas and his co-author for the Paper. He also invited further discussion by correspondence, for he felt sure the Authors would be only too pleased to deal with this.

ICI £40,000,000 Issue

Preference and ordinary stockholders registered on November 23, and employees of Imperial Chemical Industries, Limited, are to be offered £40,000,000 5½ per cent. convertible unsecured loan stock, 1977-79, at £96. This is understood to be the largest capital issue made by a British industrial company.

Each £50 stock will be convertible into ordinary shares at stated periods. The last date for applications (which must be in multiples of 50) will be January 2 when 10 per cent. will be payable, followed by 10 per cent. on allotment, 40 per cent. on March 1 and 36 per cent. on May 1. Treasury consent has been obtained and arrangements are being made to underwrite the issue.

The company states that in the 10 years to December 31, 1955 capital expenditure has amounted to about £300,000,000, of which some £210,000,000 has come from internal resources and the balance from the proceeds of two cash issues of ordinary shares and two cash issues of unsecured loan stock. The issue is required to help finance the cost of the company's expansion programme over the next few years.

Machinist/Grinder Loses Claim

An accident at the works of Firth Brown Tools, Limited, Sheffield, in August, 1954, resulted in an unsuccessful claim for damages at Sheffield Assizes last month. The plaintiff, Mr. Richard Colley (40), a machinist-grinder, was stated to have been grinding a cutting tool called an "end mill" when it flew from the grinding machine and struck him in the eye. As a result he lost his left eye.

For the defendants, it was submitted that the accident would have been avoided if Colley had behaved as a skilled machinist should. Negligence was denied.

Giving judgment with costs for the company, Mr. Justice Barry said that the plaintiff chose to use an unsuitable piece of equipment and he failed to see how the defendants could be held responsible. "I am not blaming the plaintiff," he said, "but I am not able to place any blame on the shoulders of the employers."

Mammoth Generator for UK

Plans to instal a turbo-generator of 550,000 kw. capacity are announced by the Central Electricity Authority as part of its programme of power station construction for 1962.

The generator is believed to be larger than any other unit at present projected anywhere in the world and is much larger than any now in operation. It will have an output greater than that from any one of the authority's existing power stations and will be greater than the whole of the output from the Battersea station in London. Only at Barking (London Area) and Hams Hall (Birmingham), where there are, in each case, three individual stations, is there a larger aggregate capacity of generating plant.

Also included in the programme is a number of turbo-generators each of 275,000 kw. capacity. These represent an advance on the 200,000 kw. generators at present on order for power stations in the UK.

British Oxygen Wimpey, Limited

A new private company, British Oxygen Wimpey, Limited, has been registered with a nominal capital of £10,000 in £1 shares. The company is to act as agents and contractors, consultants, and advisers for the development of plant, apparatus and buildings, and services involving chemical, mechanical, electrical and civil engineering as applied to any process or processes requiring low-temperature techniques, etc. The company will also have an interest in rocket projects.

The British Oxygen Company, Limited, and George Wimpey, Limited, have been awarded a large contract by the Ministry of Works for the erection of plant for the handling of liquid oxygen and nitrogen at Spadeadam Waste, Ministry of Works establishment in Cumberland.

Magazine for Apprentices

The first edition of a new magazine, *Apprentice*, has been published by the Industrial Welfare Society, 48, Bryanston Square, London, W.1. Its intention is to stimulate imagination and to promote thought and discussion among apprentices in industry. *Apprentice* will appear bi-monthly.

Book Reviews

Plansee Proceedings, 1955, edited by F. Benesovsky and published by Pergamon Press Limited, 4/5, Fitzroy Square, London, W.1; price 75s. net.

The text of the papers presented at the second Plansee seminar, held in June 1955, at the Metallwerk Plansee, Reutte, Tyrol, Austria, has now been published in this handsome volume, under the editorship of the head of research at the Metallwerk. The first Plansee seminar (1952) dealt with the whole field of powder metallurgy; the remarkable expansion of this branch of metallurgy, even in the short intervening period, made it necessary to limit the 1955 seminar to the discussion of a more limited field, that chosen being indicated by the sub-title of the volume: "Sintered High-temperature and Corrosion-resistant Materials." Even so, the present work runs to 472 pages, comprising 38 papers (with discussions), compared with 316 pages (29 papers) in 1952. The contributors include experts from all the main West European industrial countries, the USA, and Japan. Rather more than half the papers are in German, two in French, and the remainder in English; each is preceded by a short summary in English. They fall into four groups, dealing respectively with theoretical problems; hard materials of the type of the refractory carbides, borides, and silicides, and the special products ("hard metals" or "hard alloys") based on them; the refractory transition metals (in particular, of course, tungsten and molybdenum) and their alloys; and combinations of metallic and non-metallic components, *i.e.*, the materials now usually known as "cermets."

Many of these various products can be prepared only by the methods of powder metallurgy, and the *Proceedings* as a whole stand witness to the significant part which these techniques will play in the development and production of materials for the jet-engine and nuclear age. This is particularly reflected in such papers as those of Dr. P. Schwarzkopf on "Sintered High-temperature Materials" (the inaugural lecture of the conference, of which its author was one of the chief sponsors) and E. R. Perry and I. Jenkins on "Sintered Cobalt-based Alloy for Gas-turbine Blading," while it is of special significance that one contribution (by H. H. Hausner and M. C. Kells) is devoted to "The Rôle of Powder Metallurgy in the Design of Nuclear Power Reactors." Another paper of particular individual interest is that of A. von Zeerleder, R. Irmann and F. Leichti on "Recent Work on S.A.P." (sintered aluminium powder, a powder-metallurgy product of a peculiar type). But each of the 38 papers contributes in its own way to the considerable body of information and data here presented, giving the most up-to-date overall picture now available of the present status of powder-metallurgy science and technology in the field of high-temperature materials. The authors have provided a multiplicity of graphs, diagrams, photographs, and tables, and the volume is of a high standard of production.

W. D. J.

Tinplate Handbook (Third Edition), by W. E. Hoare, D.SC., F.I.M. Published by the Tin Research Institute, Fraser Road, Perivale, Greenford, Middlesex. *Gratis* to users of tinplate.

The fact that this handbook has reached its third edition is a testimony to its worth to users of tinplate. It has been increased in size from 31 to 44 pages. German and French translations of the book are being prepared.

New Catalogues

Continuous Cast Rods and Shapes. Enfield Rolling Mills, Limited, Brimsdown, Enfield, Middlesex, have used an eight-page, illustrated brochure to describe a new continuous process they are employing for the manufacture of long lengths of standard tin-bronze alloys in commercial shapes, such as bars and tubes. The working of the process occupies four floors. On the top storey, the metal is melted in a bath-type furnace and transferred to a totally enclosed receiver, where atmosphere (nitrogen) temperature and composition are adjusted. From the base of the furnace the metal flows continuously—there being no gap—direct into a self-lubricating water-cooled graphite die, the receiver acting as a huge runner-basin. On the third storey, there is a roller drive, which regulates the speed of withdrawal of the product of the die, whilst on the second, the rods are cut into lengths by means of a travelling saw. On the ground floor, the cast rods or tubes are turned to the horizontal, straightened and inspected. This process gives a marked increase in the tensile and impact properties, and these are set out in tabular form in the catalogue. Finally, a useful table is printed giving the weights in lb. per ft., and kilograms per metre, for diameters up to five inches.

On the back cover it is stated the sizes available for rod range from $\frac{7}{16}$- to 5-in. diameter, and for tube 1- to 5-in. outside diameter with $\frac{15}{32}$-in. inside diameter. Tolerances and diagrams of some commercial shapes are included. This interesting brochure is available to readers on writing to Brimsdown.

Iron Castings. Chamberlin & Hill, Limited, Chuckery Foundry, Walsall, has submitted an eight-page catalogue designed to aid the sale of grey-iron castings. It contains two good sales points worth noting. The first is the printing of maps to show how to reach the company's plants at both Walsall and Lichfield. The second is the stressing of the ease of machining resulting from annealing. Another good sales point is the emphasis on enhanced dimensional tolerances and improved surface finish when shell-moulding is considered. Detracting from the appearance of the booklet is the choice of a very small size for the reproduction of a picture of the mechanized plant at Lichfield. To be effective, this should take up half a page. Stress is laid on the production of a line of standard valve wheels, and, indeed, a separate information bulletin is devoted to this type of casting, which is a speciality of the company.

Heat-resisting Castings. In publication No. 1,638 the Calorizing Corporation of Great Britain, Lynton House, 7-12, Tavistock Square, London, W.C.1, detail the composition and properties of "Calmet" heat-resisting alloy steel. This is a chromium/nickel cast steel of the 25/12 class. The brochure is well illustrated and shows many castings of distinct complexity. The technical data are well presented and will enable the designer to have confidence in the use of this alloy for high-temperature applications. Readers may avail themselves of copies by writing to Tavistock Square.

Hot-blast Cupolas. Cupodel, Limited, 1294, Bristol Road, South Northfield, Birmingham, 31, have issued a well-illustrated eight-page brochure covering a system of hot-blast cupolas which are being extensively used in this country, the total capacity being over 200 tons an hour. The description of the process is clearly set out, and the illustrations, especially the coloured diagrams, add to this clarity. The catalogue is available to readers on writing to Northfield.

Fundamental Considerations for Cupola Operation*

Discussion of the Paper by W. R. Jaeschke

A short, but interesting, discussion followed the presentation of this the official Exchange Paper from the American Foundrymen's Society at the Cardiff Conference. One speaker asked how moisture was controlled in the blast and the discussion continued with questions on coke, hot-blast temperature ranges in this country compared with USA, and charging practice.

Moisture Control

A MEMBER asked how one controlled the moisture in the blast. He knew there were some blast furnaces in which moisture in the blast was brought down to zero, and in others steam was fed into the blast, to bring it up to the standard required, but he wondered how it was done in a case of a cupola.

MR. JAESCHKE, in reply, said the moisture-control equipment that he advocated was the use of a special lithium-chloride solution (Kathene) to absorb the moisture. Lithium chloride had an affinity for moisture, according to its gravity and its temperature. It was a continuous process; the proprietary solution was spread over plates in a drying chamber through which the air passed and then the used lithium chloride was returned to a regenerator and a portion of it was boiled to remove the moisture picked up and then cooled to bring it down in temperature again, before being re-circulated through the system. It was different from refrigerating systems, in which there was a cyclic effect.

Coke

ANOTHER SPEAKER asked how much loss there was when coke was graded. What amount of fines were normal between the despatch point and when the coke was delivered at the foundry? Coke being now so valuable that it was important to know something about such losses. Also, when experiments were made in cupola melting practice, what percentage of fines had to be rejected from the charges.

MR. JAESCHKE said the percentage of fines varied a good deal as between the different manufacturers of coke. Sometimes, a loss of only 10 per cent. might be experienced, but at one period in the United States of America when coke was at its very worst, around 1948, he had known as much as 50 per cent. to be rejected. Some cokes were stronger than others and then much less was lost due to fines. America covered a very large area and there were many different types of coals from which different types of coke were produced. In his own district (the Middle West) there were produced perhaps the best cokes in the country, and ordinarily the rejection of fines in the Middle-Western cokes would not be much over 10 per cent.

Blast Temperature-range Comparisons

MR. H. G. HALL said he had noticed that the Author again quoted what seemed to be a familiar figure for hot-blast work in Ameria, *i.e.* blast temperatures from 100 to 300 deg. C., which conflicted rather with the temperatures quoted on the Continent and in the UK, where 500 and 600 deg. C. were commonly used. Had Mr. Jaeschke any idea why the Americans were holding to such low blast-temperatures, and why they seemed to be afraid of the higher temperature range which was common elsewhere.

MR. JAESCHKE, in reply, said conversely why did the British insist on running up to 500 deg. C.; there was a distinct demarcation between American and European practice. One of the reasons was that equipment designed to operate at above 400 deg. C. had to be made of more expensive materials because all the common engineering metals began to fail or lose their properties noticeably above that temperature. Hence, there either had to be more use made of expensive heat-resisting alloy materials for the higher temperature conditions, or else the components had to be lined with a refractory on the inside. That all meant added expense, and if it was not done there would be high maintenance costs. Indeed, even when the high-alloy materials were used there were likely to be higher maintenance costs.

The original pioneer of the pre-heater in the United States had first brought it from Europe with the intention of operating at 425 deg. C., but presumably had discovered that even with the use of high-alloy materials, maintenance cost was too high and he had dropped the temperature to 315 deg. C., and at the present time that particular plant was operated at between 200 and 260 deg. C. It seemed that most operators in America would eventually confine themselves to operating in this range because they achieved an appreciable coke-reduction at that figure and did not introduce additional metallurgical reactions which were difficult to control. Primarily, the cupola was there to produce metal suitable for engineering castings to very rigid specification, and if one could not control it then there was no economic advantage possible. In the United States, it had been found easier to control the structural and metalurgical conditions with blast temperatures in this lower range rather than go to the higher values as was done in Europe.

There was no doubt that at the higher blast temperatures one got higher temperatures of combustion and introduced new metallurgical reactions, approaching blast-furnace conditions, but if one could not control them, then they were of no advantage. It was possible that if one had a large

* Paper presented at the Cardiff Conference of the Institute of British Foundrymen and published in the JOURNAL, July 12, 1956.

enough mixer—though, of course, the value of a mixing ladle was strictly a function of its holding capacity—one might take advantage of the higher blast temperatures and take care of varying conditions within the mixer. However, he had found that it was possible to get better metallurgical control within the American range of blast temperatures than above it.

Charging Practice

MR. T. B. BURROWS asked the lecturer if he would give his observations on charging practice. Whenever one saw a sketch of a cupola charge in a cupola, the metal and coke were represented in a nice sandwich-formation, but he had found from experience with over 60 cupolas melting heavy scrap and hematite with a scoop as in Fig. 7 of the Paper, that it did not seem to make any difference whether the coke was at the bottom and the metal on top or *vice-versa*, or whether one made a "cocktail" of it. No variation in the operation of the cupola, the melting rate or the tapping temperature, was observed.

MR. JAESCHKE replied that he had mentioned the disadvantages of the scoop or chute-loading type of charging system. So far as the order of charging the constituents was concerned, that was not too critical, but distribution within the cupola was important, and optimum results were obtained only from hand charging that was carefully supervised, or from the use of a cone-bottom charging-bucket. Even when dropped from the latter, the charge constituents did tend to mix—but the position the charge took up in the cupola and its uniformity around the periphery was much more important than any other factors. He felt sorry for ingot-mould manufacturers because their scrap material, unless it was broken, was much too large to expect the sort of results that were obtained in cupolas with the use of small scrap.

THE CHAIRMAN (Mr. H. J. V. Williams) thanked Mr. Jaeschke for his Paper, and said it was a great tribute to the Institute that he had come over personally to present it, and that he had intimated willingness to enter into written discussion.

Publications Received

Applications of Instrumentation and Automatic Control. Published by the Federation of British Industries, 21, Tothill Street, London, S.W.1; price 5s.

In the introduction to this book it is pointed out that, in spite of the inestimable value of measuring instruments, a surprisingly large number of factories and boiler-houses are operated with the bare minimum of instruments demanded by statutory regulations. It is emphasized that "in the design of new plant particular attention should be paid to the possibilities presented by the incorporation of automatic control." Such control releases labour for other duties and, "if properly applied and maintained, its use will result in a better and more consistent final product with less wastage of raw materials, thereby directly or indirectly saving power."

This booklet, which neither purports nor is intended to be exhaustive, has been compiled as a general guide to the principles and means of application of instruments and controls customarily used by manufacturing industry for steam raising and industrial processes. The text has been provided by the British Industrial Measuring and Control Apparatus Manufacturers' Association, and was written for them by Mr. A. Linford, B.SC., A.M.I.C.E., A.M.I.W.E.

Electrical Accidents and Their Causes, 1954. Published for the Factory Department by H.M. Stationery Office, York House, Kingsway, London, W.C.2; price 3s. 6d. net.

Despite the growing use of electrical power in factories, the toll of accidents has been gradually decreasing since the war until last year they reached their nadir at 707, which included 33 fatalities. For this, much credit must go to the Factory Inspectorate through their propaganda and rules and regulations. There is an interesting comment, that a further 89 fatalities occurred in circumstances outside the scope of the Factories Act (most of these, presumably, would be in homes). In the factories, more than half the accidents fall with the "up to 250-volt region" and many of these can be associated with portable items of electrical plant. The booklet, which runs to 60 pages, is certainly worth study by works and departmental managers, as, if only one accident be prevented, the time spent on perusing the publication will have been amply repaid.

Accidents: How They Happen and How to Prevent Them, Vol. 29. Published for the Factory Department, Ministry of Labour and National Service by H.M. Stationery Office, York House, Kingsway, London, W.C.2; price 1s. net.

This issue has a special negative interest for readers of the JOURNAL as not one single foundry accident is reported; this is a rare event and well worth recording. Of course, many of the accidents dealt with—and perhaps a little too vividly illustrated—are those which might occur in any industrial establishment and a knowledge of "how to prevent them" is a useful weapon to have in one's armoury.

FBI Register of British Manufacturers, 1957 (29th edition). Published for the Federation of British Industries, by Kelly's Directories, Limited, 186, Strand, London, W.C.2; price 42s. (post free).

The usefulness of a directory increases with familiarity, as it always takes a few minutes to find one's whereabouts in a new publication. This volume having reached its 29th edition, has no such disadvantage, and with the aid of the various tabs indicating the sectional divisions, reference becomes child's play. The edition follows the established make-up and constitutes a reliable work of reference for exporters and general traders.

Definitions of Heat Insulating Terms and Methods of Determining Thermal Conductivity. Published by the British Standards Institution, 2, Park Street, London, W.1. Price 5s.

Fundamentally the question of insulation is a part of fuel economy. As the campaign has spread right down to the manufacture of domestic heating appliances, many more people must familiarize themselves with the subject, and the issue of this 24-page pamphlet is to be welcomed, for it discloses and defines all the terms and constants used.

Ultrasonic Testing of Iron Castings

Equipment Installed at Goulds Foundries, Limited

At the Cardiff conference of the Institute of British Foundrymen, those members who visited the works of Goulds Foundries, Limited, were interested to witness the application of ultrasonic testing to castings of quite complex shape. What follows is an account of this inspection process and plant installed.*

At Goulds Foundries, Limited, Monmouthshire, castings are produced by the Meehanite process to provide a range of materials to meet specific requirements of the engineering trades. The automobile and aircraft industries are prolific users of these castings, with refrigeration and hydraulic applications also of major importance. However, as in all iron castings, there exists the problem of possible defects—their detection and prevention—and these brief notes indicate how this foundry has approached the problem.

Method Development

Goulds Foundries first met the question of losses due to destructive testing during the production of automobile clutch castings. In a quality production process of this description, destructive testing is obviously unsatisfactory, being highly uneconomic. Initially, Goulds Foundries concentrated on this type of particularly-large production run. The first method investigated was the use of X-rays, but it proved to be too expensive, whilst the gamma-ray technique was too slow. Turning to ultrasonic testing it was early realized that cast iron is one of the most difficult materials to test by this method. However, with the co-operation of Kelvin & Hughes (Industrial), Limited, New North Road, Barkingside, Essex, Goulds developed an ultrasonic testing technique, using a Mk. 5 supersonic flaw-detector, which now operates on a full production basis and is proving eminently satisfactory. Using a modified combined Transceiver probe, an almost unskilled operator is able to test each batch of castings at half-hourly intervals. Any batch not giving the standard reading is immediately segregated, tested destructively and the cause ascertained.

In normal ultrasonic flaw-detection work, the presence of defects is indicated by specific signals on the oscilloscope or screen, each signal denoting the reflection of part of the ultrasonic beam by a defect. In addition to these signals, a further signal is usually obtained from the reflection of the rest of the energy from the bottom of the material. This signal is known as the "bottom echo." The special technique applied to testing castings of random shapes, however, is different in that it uses the scattering effect of the defects on the ultrasonic beam. This results in less energy being reflected back to the source and is indicated on the screen by a loss in "height" of the "bottom echo"—no loss in amplitude is indicative of sound homogeneous metal. The method is quite simple in practice, and operators have been readily trained to recognize the different traces indicated on the flaw-detector screen. Since the technique is comparative, it is essential that calibration is made by first obtaining a standard "height" on a sound casting. A faulty casting will then give a signal height which is less than the standard. A record of each batch of castings is made by simple entries in a rough "log" which is transferred to a permanent book, thus preserving the record. An excerpt from the log book of the supersonic tests covering nearly a hundred samples shows that one was scrapped on account of the carbon being too high, whilst a second held temporarily in abeyance was eventually passed after sectioning and finding it sound.

Application and Establishment of Standards

The chief inspector at Goulds, who has been responsible for evolving this production technique, is convinced that, by using the flaw-detector for diagnosis of production defects, costs can be cut and production of castings increased. Indeed, on this particular application this point is amply proved. Goulds are now examining the ultrasonic testing of other, more complicated, types of castings—again using the supersonic flaw-detector as a practical tool (as distinct from a laboratory instrument), and again are meeting with success.

Establishment of an inspection standard is always difficult, but once this has been attained and the supersonic flaw-detector calibrated, any deviation from a standard signal may indicate a defect. It has been found that with systematic preliminary testing, by intelligent use of the flaw detector and particularly with co-operation between foundry and customer, such standards may be achieved. As a result, more castings produced on a quantity basis will soon be subjected to this accurate non-destructive testing technique by this company, ensuring the continuance of high quality.

* A short account of the foundries was printed in the JOURNAL, May 3, 1956, and page 258 of that issue carries an illustration of the ultrasonic test equipment.

WITHIN the next few weeks the production of tractors at the factory of the International Harvester Company, Limited, at Idle, Bradford, is expected to be stepped up to 50 vehicles a day.

FOUR HYDRAULIC LOADING SHOVELS, powered by diesel engines, were demonstrated at Tadcaster Stone Company's Jackdaw Crag Quarry, Stutton, near Tadcaster, last Thursday and Friday. The demonstrations were staged by F. S. Weatherill, Limited, of Welwyn Garden City.

New Patents

(Copies of complete specifications are obtainable from the Patent Office Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2, price 3s.)

759,254. J. B. Brennan, 13018 Lake Shore Boulevard, Cleveland, Ohio, USA.

A method of casting in which a die, closed at its upper end to form at least one downwardly directed cavity, is movable with respect to a chamber with the walls of which, the die makes sliding arrangement. The molten metal in the chamber is then urged into the, and is wholly received within, the die cavity in the under face when the die enters the material. The cavity is provided with ventilation.

759,290. Gebr. Bohler, A.G., Elisabethstrasse, 14, Vienna, 1, Austria.

An improved process for cooling billets in continuous-casting plants. The billet is guided through a cooling jacket as soon as possible after detachment from the wall of the mould owing to shrinkage, caused by cooling. The cooling jacket has cross-sectional dimensions which correspond to those of the mould. A cooling agent is sprayed direct on to the billet through openings in the inner wall of the cooling jacket.

759,292. Paul Menzen, 42, Yorkstrasse, Bochum, Westphalia, Germany.

A process for the treatment of a steel or iron melt with light metals such as aluminium, magnesium, calcium or alloys of these metals. An additive, comprising one or more light metals or alloys thereof, is introduced into the metal below the surface. This will then rise slowly towards the surface of the melt. 50 per cent. of the particles of the additive should not exceed 0.5 mm. in size.

759,301. Deutsche Edelstahlwerke A.G., 578, Gladbacherstrasse, Krefeld, Germany.

Process and apparatus for the continuous casting of metals and more particularly of the high-melting-point metals, such as steel, but they may also be employed for the continuous casting of lower-melting-point materials, such as the light metals.

759,411. Magnesium Elektron, Limited, Lumm's Lane, Clifton Junction, near Manchester, Lancs.

The invention relates particularly to magnesium-base alloys for use in the cast form (see also Patent No. 733,221, FOUNDRY TRADE JOURNAL, August 11, 1955). A characteristic composition of the alloys would be, zirconium from 2 to 0.7, manganese from 0.10 to 0.3, zinc from 0.5 to 5.0, and thorium from 1.0 to 6.0 per cent. Magnesium constitutes the balance apart from impurities.

759,480. Buders'sche Eisenwerke, 52-56, Sophienstrasse (16), Wetzlar, Germany.

The present invention claims to reduce the number of operations and manpower required in the handling of foundry mould-making machines. A machine claimed has a working station at which the moulding operation takes place. A pressure-head is adapted to be engaged with the mould box located at this working station. There are also a number of pistons and cylinders, each piston and its associated cylinder being movable relative to one another under the action of fluid supplied under pressure; this effects all the working steps of a moulding operation. Common regulating means are provided for controlling the supply of fluid so as to cause relative movement of the respective pistons and cylinders in a pre-determined sequence to effect the working steps. Moulding machines constructed in accordance with the invention may be either of the turnover or non-turnover type.

759,593. J. B. Brennan, 13018, Lake Shore Boulevard, Cleveland, 8, Ohio, USA.

A method of making liners for moulds for casting molten metal. According to the inventor there is provided a method of making liners for a surface on or against which the metal is to be cast. A liquid suspension of heat-resisting fibres is formed, which is then applied to the face of a porous backing. The opposite face of the backing is subjected to sub-atmospheric pressure so as to form a layer of fibrous material which will assume the shape of part at least of the articles to be cast.

759,587. Allied Ironfounders, Limited, 28, Brook Street, London, W.1.

Moulds for the centrifugal casting of pipes and other tubular bodies from high-melting-point metals such as iron and steel. (This is a modification of Patent No. 728,126.) The moulds concerned are of the "permanent" type which are not given a lining of sand or other refractory, and which are not externally jacketed.

The invention claims to provide a method for prolonging the life of these moulds. A co-axial sleeve of permanent material is formed as an integral extension of that end of the mould to which the molten metal is fed. The sleeve possesses initially a smooth, unobstructed bore, constituting a pouring surface upon which the molten metal to be cast is poured for introduction into the unlined surface of the mould. The internal diameter of this sleeve (at least at its inner end) is less than that of the mould bore, so that the inner end of the sleeve is adapted to determine both the length and thickness of the casting. Any surface breakdown, caused by initial impact of the molten metal, takes place in the sleeve, the damage to the casting surface of the mould itself being thereby considerably reduced.

759,895. Eisenwerke Gelsenkirchen, A.G., 2 to 4 Hohenzollernstrasse Gelsenkirchen, Germany.

A white, solidifying cast-iron alloy suitable for the production of high-speed malleable cast iron. It has a composition of carbon 2.5 to 3.5, silicon 1.5 to 3, and sulphur 0.3 to 1 per cent by weight. Manganese and phosphate present as impurity are kept below 0.5 and 0.15 per cent. respectively. A seeding agent (either one or more of ferro-silicon, aluminium, boron or zirconium) is used during the production of the alloy.

Recent Wills

BATTY, HARRY, founder of H. Batty & Company, iron-founders, of Stockport £13,044

LOWE, E. J., a director of Thos. Firth & John Brown, Limited, Sheffield £22,422

MEARS, L. C., a director of E. McKinnon & Company, Limited, brassfounders, etc., of Birmingham £8,164

WRIGHT, G. M., of Danbury (Essex), formerly engineer-in-chief of Marconi's Wireless Telegraph Company, Limited £295

MUSGRAVE, B. H., of Welwyn (Herts), a director of the Telegraph Construction & Maintenance Company, Limited, and Submarine Cables, Limited £14,023

MARKLAND, A. D., of Rugby, for more than 20 years assistant manager of the turbine sales department of the British Thomson-Houston Company, Limited £6,142

ENTWISTLE, JOSEPH, a director of H. J. Baldwin & Company, Limited, manufacturers of cable covers, of Nottingham, and of Mersey Cable Works, Limited £9,915

Company News

FRY'S (LONDON), LIMITED, hand-tool manufacturers and factors, of London, S.E.10—The company, which was made public last January, recommends a final dividend of 10 per cent., making 17½ per cent. for the year to July 31. This exceeds by 2½ per cent. the forecast announced in the information statement. Group profit advanced from £35,733 to £44,513 and after taxation, net profits rose from £18,083 to £21,788.

ASSOCIATED ELECTRICAL INDUSTRIES, LIMITED—The company is offering holders of the 1,000,000 4 per cent. second preference units in Siemens Bros. & Company, Limited, due to be redeemed on January 1 at 22s. per £1 unit, 94 AEI 4½ per cent. "B" cumulative preference £1 shares and 16 ordinary £1 shares for every £100 of stock surrendered. The offer closes on December 28. Siemens is already a member of the AEI group.

STEEL & COMPANY, LIMITED, engineers, etc., of Sunderland—Provisional results of two thirds of the year's work show that trading is very satisfactory and prospects for the remaining months to the end of March, 1957, are excellent. The directors' belief is that they will be able to report profits as good as, and perhaps better than, those of last year, when trading profit, etc., was £865,786, net profit was £297,604, and total dividend was 17½ per cent.

ENGLISH ELECTRIC COMPANY, LIMITED—There will not be a drawing this year, the directors state, of the 4 per cent. debenture stock (1965-85) or the 4½ per cent. debenture stock (1972-77) because the company has made purchases in the market up to the amount set aside for the sinking fund. Taking these purchases, totalling £62,665 and £161,453 respectively, into consideration the outstanding 4 per cent. debenture stock amounts to £2,658,346 and the 4½ per cent. to £4,855,333.

WM. SIMONS & COMPANY, LIMITED, engineers, etc., of Renfrew—The new offer, dated November 3, by G. & J. Weir, Limited, engineers and founders, of Glasgow, to purchase the ordinary and preference share capital has been accepted by the holders of each class of more than 90 per cent. The sale of the shares comprised in such acceptances will therefore be completed in terms of the offer on or before January 7 and instructions on further procedure will be sent to shareholders.

INDIAN IRON & STEEL COMPANY, LIMITED—By the direction of the ordinary shareholders, the company's annual meeting was adjourned by the chairman to 4 p.m. on December 7 in token of the shareholders' protest against the limitation imposed on the ordinary dividend. Holders were informed in October that the Indian Government had been unable to agree to any increase in the dividend rate and the recommended payment for the year to March 31, 1956, was accordingly held at 10 per cent.

BERTRAMS, LIMITED, engineers and ironfounders, of Edinburgh—Net profit for the year to September 30, 1956, was £63,755, against £44,173 for the previous year and the dividend was 20 (15) per cent. The directors state that the value of the turnover was a record, some of the arrears of work-in-progress being overtaken, although conditions deteriorated in the latter half of the year. Orders in hand cover fully 18 months' full employment, but competition abroad is keen and while prospects are good, profit margins are decreasing.

ASSOCIATED BRITISH ENGINEERING, LIMITED—In declaring an unchanged interim dividend of 4 per cent. on the £1,057,890 ordinary capital the board reports that group turnover has been well maintained, but, in common with industry generally, increased costs in material and wages have had to be absorbed. The volume of new orders received has been satisfactory and the order-book of the group shows a healthy position. Group trading profit, etc., for the period from April 1 to October 13, 1956, approximates to £257,000, against £267,000 for the corresponding period of the previous year. Group net profit, after tax of £108,000 (£100,000), amounts to £119,000 (£139,000). The 6 per cent. final makes a total of 10 per cent. for the year to March 31, 1956.

BROWN BAYLEY'S STEEL WORKS, LIMITED—The directors are now considering a scheme to reorganize the company's capital which will reduce the "top heavy" quotation a share, bring the capital more into line with its net position, and render the dividend expressed as a percentage of the issued capital more realistic, says the chairman, Mr. J. W. Garton, in his statement with the accounts. The directors, however, have been advised that before recommending it they should obtain a ruling from the Inland Revenue that will not involve the company in the loss of the relief from profits tax in respect of retained profits which it has received in the past and which amounts to about £160,000 (*i.e.*, over 10s. a share). The necessary submission has been made to the Inland Revenue.

SAMUEL OSBORN & COMPANY, LIMITED, steelmakers, etc., of Sheffield—Group turnover in value and volume was the highest ever in the year ended July 31 last. After depreciation, etc., of £418,153 (£278,642), the consolidated manufacturing and trading profit expanded from £890,750 to £1,256,122 and the net balance attributable to the holding company rose from £503,901 to £641,043. The dividend is raised by 5 per cent. to 32½ per cent. Mr. F. A. Hurst, chairman, says that all the manufacturing companies are still busy and in nearly every case there have been departments working longer hours to compensate for the shortage of skilled workmen. It is not possible to forecast how long this busy period may continue. The recession in the motor-car industry did not affect the group appreciably.

VACTRIC, LIMITED, electrical and mechanical engineers, of London, W.1—The company is paying an interim of 10 per cent. for the year to March 31, 1957, on the combined £450,000 ordinary and "A" ordinary capital. For the previous year there was a single 17½ per cent. payment following scrip issues to ordinary holders of 50 per cent. in 6 per cent. preference and 50 per cent. in "A" ordinary. Group net profit for the half-year ended September 30, 1956, after depreciation of £50,227, but before tax, amounted to approximately £275,000, compared with £539,583 for the full year ended March 31, 1956.

ALLIED IRONFOUNDERS, LIMITED—A fall of about 10 per cent. in sales and profits of its UK companies is reported for the first half-year to September 30. As the result of this and other factors the interim dividend on the £4,875,918 ordinary is lowered from 5 per cent. to 3¼ per cent. The board also states that profits for the second half-year—which normally is better than the first half—are likely to be affected by the fuel crisis. The problems anticipated in starting up an entirely new plant in Australia have proved more obstinate than was expected, the directors report, and a substantial loss has been made in the first half-year; further loss is to be expected before economic production is attained.

News in Brief

BROOK MOTORS, LIMITED, announce that its Aberdeen sales office moved to larger premises on December 10, at 1, Bon Accord Crescent; the telephone number is the same—Aberdeen 21890.

THE BRUSH ELECTRICAL ENGINEERING COMPANY, LIMITED, of Loughborough, has obtained a contract from Imperial Chemical Industries Limited, for six gas-expansion turbines. They will range in output from 3,000 h.p. downwards and will be installed on a new chemical plant.

THE WORKSHOP BLOCK of a new College of Technology at Hull, was opened by Lord Hives, chairman of Rolls-Royce Limited, and chairman of the National Council for Technological Awards, on December 3. The block has cost £312,000 and its equipment an additional £127,000.

THE WHOLE of the share capital of J. & W. Somerville, Limited, Lennoxtown (Stirlingshire), has been purchased by the Coltness Iron Company, Limited, Glasgow. J. & W. Somerville, Limited, was established more than 150 years ago and is the third largest manufacturer of nails in Britain.

A.E.I. LAMP AND LIGHTING COMPANY, LIMITED, announce that new engineering development laboratories are being built at Leicester adjacent to the Lamp Works at Melton Road. The foundations of the new building have already been laid and it is expected to be completed in the course of the next 18 months.

LANCASHIRE DYNAMO HOLDINGS have now acquired the business of J. G. Statter & Company, Limited, the electrical switchgear manufacturers of Amersham Common, Bucks. For this purpose, the capital of Lancashire Dynamo Holdings has been increased to £3,000,000 by the creation of 500,000 ordinary shares of £1 each.

A WELL-KNOWN landmark, the 160-ft. high chimney at the works of Newton, Chambers & Company, Limited, Thorncliffe, near Sheffield, was demolished on December 1. The chimney was erected 41 years ago for the coking plant of Thorncliffe Colliery, which closed in 1923. For the past two years the chimney has been floodlit at night.

OF the Vitreous Enamelling Development Council formed to promote, develop, and publicize the progress of the industry, the chairman is Mr. S. W. Vickery, managing director of Ferro Enamels, Limited, and the secretary Mr. M. Hopkins, managing director and secretary of the Welsh Tinplate & Metal Stamping Company, Limited.

PROJECTS estimated at over £2,000,000 proposed for inclusion in the 1959-60 London County Council building programme for further education were approved for submission to the Council by the LCC Education Committee on December 5. Most of the work is for future needs of the proposed colleges of advanced technology.

FORMALITIES have been completed for the purchase by Tube Investments, Limited, of the whole of the share capital of Bennett Tools, Limited, of Redditch, high-precision engineers. Mr. R. Bennett, the founder of the business, will continue as its managing director. Mr. E. L. Burton and Mr. R. D. Young, of Tube Investments, have joined the Board.

Mr. J. C. THOMPSON, chief buyer for Edgar Allen & Company, Limited, steelfounders, etc., Sheffield, spoke to the local branch of the Offices Management Association, Limited, on December 4, on "The Office and the Buyer." He said that far too little was known about industrial purchasing and emphasized the importance of close inter-departmental contacts and of good relationships between vendor and seller.

AN INTERNATIONAL CONGRESS AND EXHIBITION of "Measuring Instrumentation and Automation—IKAMA" is scheduled for November 2 to 10, 1957, in Düsseldorf. The exhibition will include the following fields: Measuring, telemetering and control instruments for processing quantities in bulk as well as analytical equipment for production control and research. The organization is in the hands of Nordwestdeutsche Ausstellungs-Gesellschaft m.b.H. (NOWEA), Düsseldorf.

THE NEXT CONFERENCE of the *Association Technique de la Fonderie de Belgique* will be held from May 2 to 4, 1957, at Liège, during the run of the exhibition being held there covering mining, metallurgy and engineering and which includes a special section exhibit covering foundry practice. The subjects to be dealt with at this conference include, cement/sand moulding; shell moulding; jarr and squeeze moulding machines; moulding by impeller ramming; fast-drying cores; core blowing and the CO_2 Process.

SHEFFIELD AND DISTRICT CLEAN AIR COMMITTEE decided on December 4 to authorize the Town Clerk, Mr. John Heys, to seek from the Minister of Housing and Local Government permission to exercise rights and duties regarding certain industrial processes, including metallurgical and ceramic. They were of the view that they had the necessary technical staff qualified to perform such duties. It was reported that the committee had served 27 abatement notices on smoke offenders in November.

THE Glasgow firm of Cockburns Limited, have secured a £22,000 order for the supply of shipbuilding equipment to Italy. The order is for turbine-control gear for five tankers now under construction at Trieste for American owners; the turbines are being made in the US. A spokesman for the firm said this was the largest single order they had ever had from Italy. In order to meet increasing export orders for steam valves and control gear the firm are to extend their main works at Meiklewood Road, Cardonald. Adjoining premises have been acquired to give an extra 40,000 sq. ft. of floor space.

NEWTON CHAMBERS & COMPANY, LIMITED, Thorncliffe Works, Sheffield, will pay their 4,000 workers a profit share bonus this Christmas, equal to two thirds that of the last two years; they will receive one week's extra pay, compared with one-and-a-half week's bonus pay in 1954 and 1955. In the announcement the firm point out that the reduced bonus is due to increased rates of taxation compared with substantial reductions in income tax in the last two years. All who have been employed since the beginning of the year will get the extra week's pay. Those who have joined since January 1 will receive bonus in proportion to their length of service.

THE NON-DESTRUCTIVE TESTING GROUP of the Institute of Physics, in News Sheet No. 2, announce that the geographical distribution of members supports the present policy of holding monthly meetings in London, and summer meetings in the Provinces. Because the Institute's convention is to be staged at Oxford from July 10 to 13, 1957, the customary summer meeting of the Group will not be held. It is hoped, however, to arrange a two-day provincial meeting towards the end of that year. The news sheet concludes with notes on the Group library scheme and lists 16 publications which are available, mainly relating to the non-destructive testing of metals by radiographic methods.

(*Continued on page 714*)

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News in Brief

(*Continued from page 712*)

BIRMINGHAM CHAMBER OF COMMERCE FINANCE COMMITTEE has recommended the Chamber to limit its suggestions for taxation relief in the 1957 Budget, because of the expected economic repercussions of the Middle East crisis and the additional strain on the balance of payments position. The report, considered by the Council of the Chamber on November 26, says that such taxation relief as may be possible should be primarily directed towards assisting industry to meet foreign competition; investment allowances for industry should be reinstated at the earliest possible date. In view of the need to control inflation, the committee was not in favour of purchase-tax reductions, but it did think that the level of Government expenditure should be reduced.

THE PRICE OF REFINED NICKEL in the UK has been raised by the International Nickel Company of Canada, Limited, to £600 per ton delivered works. There are appropriate increases for other countries. The previous increase was in November, 1954, when the price was raised to £519 from £483 a ton. The Mond Nickel Company, Limited, has made a similar announcement. The Canadian company plans the development over the next three to four years of a $175,000,000 nickel project in northern Manitoba, where two new nickel mines are to be opened. The project will constitute the biggest nickel-producing operation in the world next to Inco's operations in the Sudbury district of Ontario, and will be the largest single investment of any kind in Manitoba.

AS A RESULT of industrial injuries, £300,000,000 is lost annually, said Dr. R. A. Trevethick, when he spoke to members of Hadfields, Limited, Sheffield, Ambulance Society at their 48th dinner on Saturday, December 1. He said that treatment of the injured was not enough, they must also help to prevent accidents. He traced the pattern of first-aid development in factories during the past 50 years and said that even greater changes were envisaged for the near future. Dr. James Gregory, resident medical officer at the firm, emphasized the need for ambulance workers to help in the prevention of accidents to lower the incident rate. Mr. Sam Leetch, chairman of the Society, who presided, stated that it was essential that more and more younger men should be trained in first aid.

SPEAKING AT DUDLEY on November 28, Sir Eric Carpenter, past-president of the Association of British Chambers of Commerce, said, with reference to the free trade bloc, "the problem which faces us is whether we are going to be an interested onlooker on the sidelines, as we were with the steel market, or whether we are going to become the dominant country controlling and shaping that market and controlling its development. There is no doubt that there is going to be this integration of Europe as a free market and unless we do something about it, Western Germany is going to be the dominant country in that integration." He added, "we cannot afford to keep out because enormous changes have taken place in the character of our export trade." If Britain was to remain a major trading nation it was imperative for everyone in industry and commerce to make a united effort, Sir Eric urged. Britain still had world supremacy in technical workmanship provided it could be applied, but the mistrust which exists between employer and labour must end. There was a time when Britain relied almost solely on consumer goods but the scale had now swung until her exports were predominantly capital goods. British industry must be ready to supply the developing countries with their needs in capital goods.

Obituary

The death occurred recently of Mr. JAMES BAIRD DOUGLAS, a director of William Bain & Company, Limited, general engineers, of Coatbridge (Lanarkshire).

The death is announced of Mr. FREDERICK E. STOKELD, F.I.M., chief chemist and metallurgist of the Deritend Stamping Company, Limited, and a past-president of the Birmingham Metallurgical Society.

Mr. RICHARD BERNARD EDWARDS, managing director of Edwards (Nottingham), Limited, manufacturers of sewing machines and equipment, died on November 30. The family name has been connected with the trade for more than 70 years.

Mr. GEORGE S. BLACKBURN, who has died at the age of 63, was a director of the Bentley Engineering Company, Limited, Leicester, and managing director of George Blackburn & Sons, Limited, hosiery machinery manufacturers, of Nottingham.

The death is reported of Mr. JOHN ROMAINE GOVETT, chairman of the Consolidated Zinc Corporation. Mr. Govett was a partner in the Stock Exchange firm of Govett, Sons & Company, in the inter-war period, and in 1926 joined the board of the Corporation.

The death occurred on December 3 of Major R. A. TELFORD, at the age of 81. A pioneer member of the Institute of Clay Technology, Major Telford was chairman of Bradley & Craven, Limited, brick machinery manufacturers, Wakefield, which company he joined as an apprentice in 1894. He was elected to the board of directors in 1921, and he was also a director of the Claughton Manor Brick Company.

The funeral took place at Pinner (Middx) on December 4 of Dr. JOHN HENRY PARTRIDGE, who had been president of the Society of Glass Technology since April. Dr. Partridge was trained as a metallurgist and joined the research laboratories of the General Electric Company, Limited. He specialized in glass and refractories and was responsible for most of the GEC's glass development. He was secretary of the Society of Glass Technology for many years.

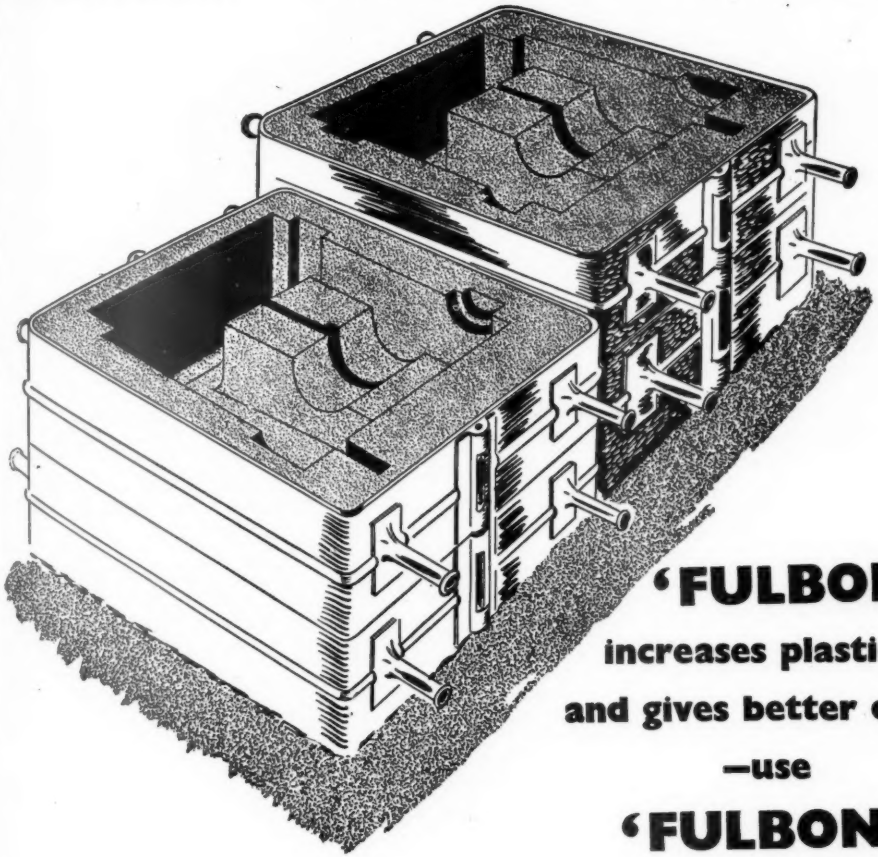
Mr. VERNON PROCTOR, a former Sheffield industrialist who received the O.B.E. for his work in the production of munitions, after the 1914-18 war, died recently at the age of 70. He was connected with Cammell Laird & Company, Limited, Birkenhead, for 18 years before 1921. From 1921 until the outbreak of war in 1939 he was in the steel trade on his own account. He joined the Ministry of Supply in October, 1939, and in 1942 was made Regional Controller for the Ministry, operating from Sheffield and Leeds. Mr. Proctor was a director of R. Hostombe, Limited, Sheffield.

Aboe (Marine), Limited

A member factory of the Brush Group, Limited, J. & H. McLaren, Limited, is now directly concerned with sales of the group's marine diesel engines in the small- and medium-horsepower range.

The factory was formerly a member of Associated British Oil Engines (Marine), Limited, which controlled marine sales and which has now been formed into two companies to control the marine sales of the National Gas & Oil Engine Company, Limited, and Mirrlees, Bickerton & Day, Limited.

DEEP DRAWS...



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Raw Material Markets

Iron and Steel

While many foundries are able to obtain fairly good outputs of castings, activity varies in different sections of the trade, and there is some uncertainty so far as future business is concerned. This is particularly evident at the engineering foundries which cater mainly for the motor vehicle trade. Reduction in output and short-time working have resulted in big cuts in schedules for castings. Some of these foundries have already intimated that they will be forced to go on to a three-day working week. This is likely to entail a further reduction in their requirements of pig-iron in the low-phosphorus grades and hematite, both of which are at present adequate to cover demands. Many of the other engineering and speciality foundries producing high-duty castings for busy trades continue to take up good tonnages.

The textile foundries have capacity available for more work and many of the light foundries are similarly placed.

Generally the light-casting trade has had a lean time for a long period and conditions have not shown the improvement expected. The building trade is taking up fair tonnages, but apart from cast-iron pipes, which are in good demand, its requirements for other types of casting are not so brisk. Jobbing foundries have a fair amount of work on hand.

The supply of high-phosphorus pig-iron, although still on a reduced scale, is generally adequate, but stocks at both furnaces and foundries are comparatively small. With the reduced number of furnaces now producing this grade, there are delays in obtaining analyses required, particularly in the higher silicon ranges.

The re-rollers continue to obtain good outputs, and there are adequate supplies of steel semis. Home users continue to take up the major portion of the outputs of small bars, light sections, etc., and there is a ready market abroad for any tonnages to spare. Home steelworks maintain good deliveries of steel semis and some consignments, although not on a large scale, continue to be received from abroad. Stocks of billets, etc., at the re-rolling mills are not now so large, and pressure on home steelworks for supplies is increasing.

There is a brisk demand for small sized billets and also for carbon and alloy steels.

Non-ferrous Metals

On Friday, the Board of Trade announced that it is about to make arrangements for reducing its stocks of lead and zinc. This is in accordance with the policy announced in February of running down the strategic holdings of industrial raw materials.

The Board stated that it is anxious to make its disposals of lead and zinc without unduly disturbing markets and that it would shortly be discussing with trade representatives how best this could be done. The rate at which disposal will be made will not be decided until after the discussions. No sale will be made before the middle of January. Both lead and zinc prices reacted sharply following the Board of Trade announcement.

Copper has been steady, while the lessening in political tension also served to steady the tin market. On Monday, however, tin for immediate delivery fell to £807 10s. a ton at one time in active trading. Three months delivery metal was down to £798 at one point.

Conductivity and Non-destructive Testing

The Non-destructive Testing Group of the Institute of Physics, under the chairmanship of J. Thewlis, D.SC., F.INST.P., announce that at a meeting to be held to-morrow, Dr. R. W. Powell, F.INST.P. (of the National Physical Laboratory, Teddington), will speak on "Conductivity Test Methods and Results." A synopsis indicates that the main purpose of the lecture will be to show ways in which the conducting properties of materials can be employed as the basis of non-destructive test methods. Both thermal and electrical conductivity will be considered and comparison made of their relative values for tests of this kind. Methods normally employed for thermal-conductivity determinations will also be described and a general account will be given of the thermal-conducting properties of materials and of the nature of their dependence on temperature. Some consideration will also be given to the relation between conductivity and other properties.

NUM and Fuel Rationing

THE Midland Council of the National Union of Manufacturers, after a meeting on December 3, to discuss the fuel situation, issued a statement which said that the Government's rationing scheme was bound to lead to considerable unemployment. The statement declared that the rationing scheme, as at present envisaged, was unfair to business interests in regard to power, heat and transport. The Council urged that the scheme should be immediately reconsidered by the Government in consultation with representatives of national industrial bodies.

In the meantime it is recommended that difficulties could be relieved by the removal of restrictions on the operation of C licence vehicles to enable firms to share their available transport and eliminate wasteful empty mileage for goods vehicles. Members did not share the Government's view that the railways could provide the solution of industry's transport difficulties said Mr. W. F. Wentworth Shields, Midland area secretary of the NUM. Many kinds of goods were unsuited to consignment by rail and many firms lacked the facilities such as sidings to take advantage of the railways.

Information Please

A letter the Editor of the JOURNAL has received from America asks for a European source of supply for "open venting hose," for incorporation in moulds or cores. Apparently, it looks very much like a nylon product openly woven in the form of tubes, and is used to provide venting in a conventional manner to replace wax vents or metal tubing. Any help readers or advertisers can give will be much appreciated.

Careers in Industry

A "Financial Times" survey in supplement form entitled "Careers" is intended to be of use and interest to all who are connected in any way with the problems of graduate and school-leaver employment. It contains much data on industrial employment generally, and also on the professions. The supplement includes an article by Prof. I. C. F. Statham, "The Mining Engineer," and one on "Advancement in the Iron and Steel Industry," by C. T. Williams.

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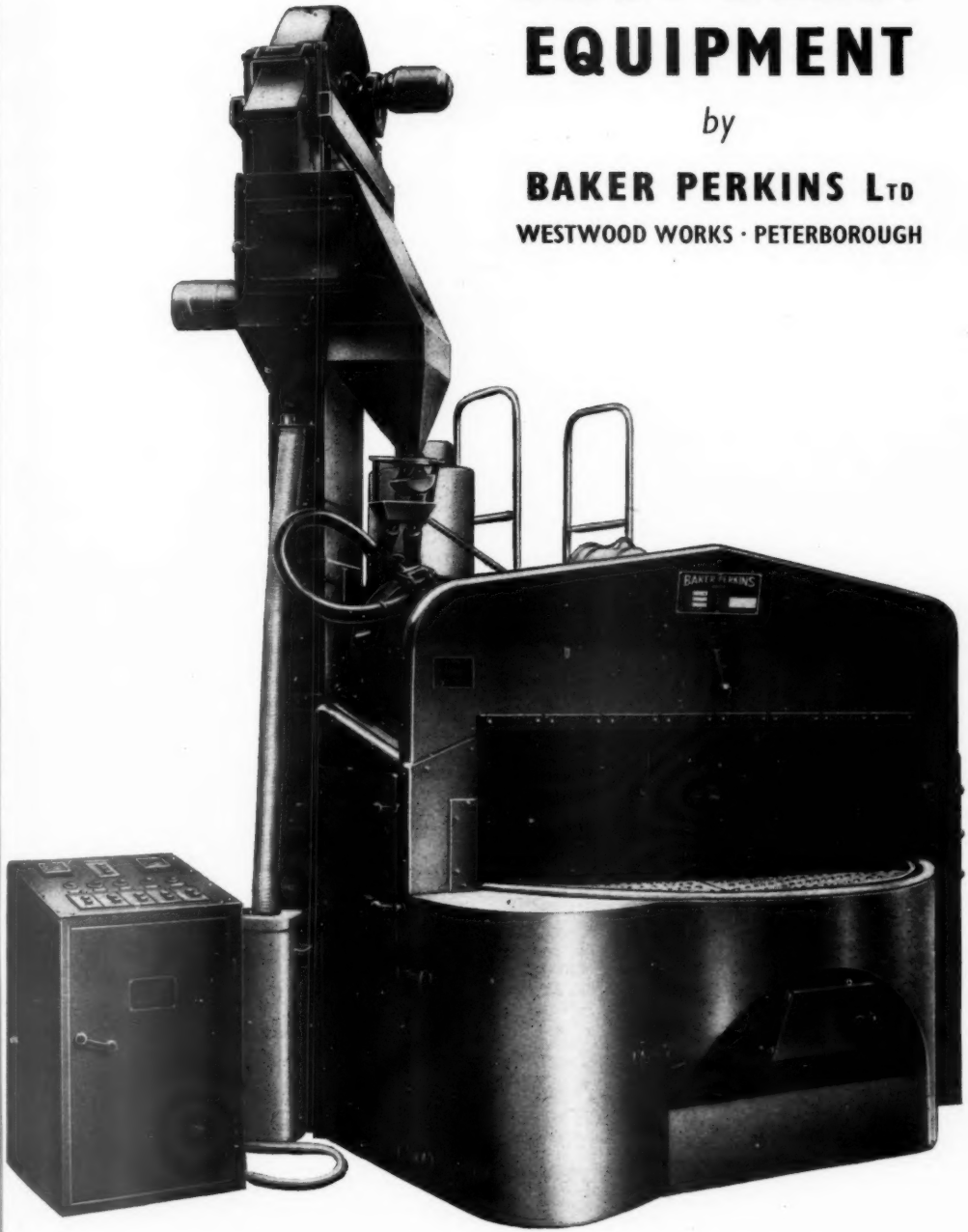

Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

December 11, 1956

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £17 11s. 0d.; Birmingham, £17 3s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £20 8s. 0d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £20 12s. 3d.

Scotch Iron.—No. 3 foundry, £21 14s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £23 16s. 6d.; South Zone, £23 19s. 0d.

Refined Malleable.—P, 0.10 per cent. MAX.—North Zone, £25 4s. 0d.; South Zone, £25 6s. 6d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. of England (local iron), £21 7s. 6d.; Scotland (Scotch iron), Zone S. 1, £21 14s. 0d.; Sheffield, £22 14s. 6d.; Birmingham, £23 2s. 0d.; Wales (Welsh iron), £21 7s. 6d.

Basic Pig-iron.—£18 3s. 0d. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots and over).—45 per cent. Si, £50 0s. 0d. to £51 15s. 0d., scale 17s. 0d. to 17s. 6d. per unit; 75 per cent. Si, £70 0s. 0d. to £75 7s. 6d., scale 17s. 0d. to 17s. 6d. per unit.

Ferro-vanadium.—50/60 per cent., 27s. 6d. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 12s. 3d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £250 0s. 0d.; 38/40 per cent., £299 0s. 0d.

Ferro-tungsten.—80/85 per cent., 16s. 0d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 19s. 0d. per lb. of W.

Ferro-chrome (6-10 ton lots).—4/6 per cent. C, £96 0s. 0d. to £96 10s. 0d., basis 60 per cent. Cr, scale 33s. 0d. to 31s. 0d. per unit; over 6 per cent. C, £94 0s. 0d. to £95 10s. 0d. basis 60 per cent. Cr, scale 31s. 0d. per unit; 2 per cent. C,* 2s. 1½d. per lb. Cr; 1 per cent. C,* 2s. 2d. per lb. Cr; 0.15 per cent. C,* 2s. 2½d. per lb. Cr; 0.10 per cent. C,* 2s. 2¾d. per lb. Cr; 0.06 per cent. C,* 2s. 3d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 7s. 0d. to 7s. 6d. per lb.

Metallic Manganese.—93/95 per cent., carbon-free, £269 0s. 0d.; 96/98 per cent., £279 0s. 0d. to £285 0s. 0d.

Ferro-columbium.—65/75 per cent., Nb + Ta, 22s. 6d. to 23s. 6d. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £75 0s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £28 19s. 0d.; tested, 0.08 to 0.25 per cent. C, £29 19s. 0d.; hard (0.41 to 0.60 per cent. C), £31 0s. 6d.; silico-manganese, £39 10s. 0d.; free-cutting, £33 3s. 0d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £36 14s. 6d., silico-manganese, £39 17s. 6d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £34 13s. 6d.; basic, hard, over 0.41 up to 0.60 per cent., C, £35 16s. 0d.; acid, up to 0.25 per cent. C, £38 17s. 6d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £35 7s. 0d.; boiler plates (N.-E. Coast), £37 17s. 0d.; floor plates (N.-E. Coast), £36 16s. 0d.; sectional material, N.-E. Coast, £33 16s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested (4-ton lots), £36 3s. 0d.; flats, 5 in. wide and under (4-ton lots), £36 3s. 0d.; hoop and strip, £36 12s. 6d.; uncoated strip mill coils, not rolled, under 3mm. to 12g., £38 16s. 0d.; black sheets (hand mill), 17/20 g., £50 4s. 6d.; galvanized corrugated sheets, 24 g., £62 2s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £61 13s. 9d.; nickel-chrome, £85 10s. 6d.; nickel-chrome-molybdenum, £96 16s. 6d.

NON-FERROUS METALS

Copper.—Cash, £272 0s. 0d. to £272 10s. 0d.; three months, £273 10s. 0d. to £274 0s. 0d.; settlement, £272 10s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 2s. 7½d. per lb.; rods, 306s. 3d. per cwt. basis; 20 s.w.g., 339s. 6d. per cwt.

Tin.—Cash, £808 0s. 0d. to £809 0s. 0d.; three months, £796 0s. 0d. to £797 0s. 0d.; settlement, £809 0s. 0d.

Lead (Refined Pig).—First half December, £112 5s. 0d. to £112 7s. 6d.; first half March, £112 5s. 0d. to £112 10s. 0d.

Zinc.—First half December, £98 0s. 0d. to £98 10s. 0d.; first half March, £94 10s. 0d. to £94 15s. 0d.

Zinc Sheets, etc.—Sheets, 15 g. and thicker, all English destinations, £131 5s. 0d.; rolled zinc (boiler plates), all English destinations, £129 0s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £115.

Brass Tubes, etc.—Solid-drawn tubes, 2s. 2d. per lb.; rods, drawn, 3s. 1⅛d.; sheets to 10 w.g., 232s. 0d. per cwt.; wire, 2s. 10¼d.; rolled metal, 232s. 0d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £205; B6 (85/15), —; BS249, —.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £253 HTB2 (38 tons), —; HTB3 (48 tons), —.

Gunmetal.—BS1400, LG2 (85/5/5/5), £282; LG3 (86/7/5/2), £292; G1 (88/10/2/½), £343; (88/10/2/1), £336.

Phosphor Bronze.—BS1400, PB1 (AID released), £360 per ton.

Phosphor Bronze Strip, etc.—Strip, 328s. 6d. per cwt.; sheets to 10 w.g., 328s. 6d. per cwt.; wire, 4s. 3⅝d. per lb.; rods, 3s. 8d.; tubes, 3s. 6¼d.; chill cast bars: solids 3s. 8d., cored 3s. 9d. (CHARLES CLIFFORD, LIMITED).

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 4s. 0d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 4¾d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 4s. 3¾d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 5½d. per lb. Antimony, English, 99 per cent., £210 0s. 0d. Quicksilver, ex-warehouse, £83 10s. 0d. Nickel, £600 0s. 0d. Aluminium ingots, £198 10s. 0d.; aluminium bronze (BS1400), AB1, £295; AB2, £305. Solder, brazing, BS1945, type 8 (50/50), 3s. 1d. per lb., type 9 (54/46), 3s. 4½d. per lb.

* Average 68–70 per cent.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference ESB can be obtained from the Board of Trade Export Services Branch, Lacon House, Theobalds Road, London, W.C.1 (telephone: CHAncery 4411, ext. 738 or 771), unless otherwise stated.

DAGENHAM, January 5—Iron castings, etc., for the year commencing April 1, 1957, for the Borough Council. The Borough Engineer and Surveyor, Civic Centre, Dagenham (Essex).

FORMOSA, December 17—Locomotive boiler tubes, for the Central Trust of China, Purchasing Department. (ESB/30408/56/ICA.)

INDIA, January 11—Mobile crane, for the Director General of Supplies and Disposals. (ESB/30095/56.)

LONDON, S.W.2, January 2—Iron castings, tools and implements, etc., for 12 months from April 1, 1957, for the Lambeth Borough Council. Mr. F. Batterbury, borough engineer, Lambeth Town Hall, Brixton Hill, London, S.W.2.

NORTHWOOD, January 12—Castings for the year commencing April 1, 1957, for the Ruislip-Northwood Urban District Council. The Engineer and Surveyor, Council Offices, Northwood (Middx).

PORTSMOUTH, December 19—Castings, lime, etc., for 12 months from April 1, 1957, for the City Council. Contracts and Supplies Section, City Treasurer's Department, 48/51, Clarence Parade, Portsmouth.

SCUNTHORPE, December 22—Castings, small tools, etc., for the period ending March 31, 1958, for the Borough Council. Mr. Cyril Cooper, borough surveyor, Laneham Street, Scunthorpe (Lincs).

SOUTH AFRICA, December 20—Screening and crushing plant, for the Union Tender and Supplies Board. (ESB/30269/56.)

SOUTH AFRICA, January 11—Electrically heated furnaces, for the Stores Department, South African Railways. (ESB/30143/56.)

STAFFORD, January 8—Provision and installation of one automatically controlled, electrically driven, vertical spindle centrifugal pump, for the Borough Council. Mr. T. H. Higson, borough surveyor, Mount Street, Stafford. (Deposit £1 1s., returnable.)

Forthcoming Events

DECEMBER 18

Institute of British Foundrymen

East Anglian section:—Film evening, 7.30 p.m., at the Lecture Hall, Public Library, Ipswich.

Incorporated Plant Engineers

Glasgow branch:—"Heating and Ventilation of Factories," by D. T. Jenkins, M.Sc.(ENG.), 7 p.m., at the Scottish Building Centre, 425/427, Sauchiehall Street. (Joint meeting with the Institute of Heating and Ventilation Engineers.)

Sheffield Metallurgical Association

Film night, 7 p.m., at British Iron and Steel Research Association, Hoyle Street, Sheffield, 3.

DECEMBER 19

Incorporated Plant Engineers

Kent branch:—"Plant Planning and Development," by A. W. Western, 7 p.m., at the King's Head Hotel, High Street, Rochester.

DECEMBER 20

Institute of Production Engineers

Glasgow section:—"Metallurgy and the Production Engineer," by T. G. Strong, 7.30 p.m., at the Institution of Engineers and Shipbuilders, 39, Elmbank Crescent.

JANUARY 5, 1957

Institute of British Foundrymen

West Riding of Yorkshire branch:—"Pressure-cast Aluminium Patternplates," by H. Howlett, 6.30 p.m., at the Technical College, Bradford.

FRY'S METAL FOUNDRIES, LIMITED, has had plans prepared for the erection of an additional storey to the factory in Bridge Road, Mitcham, Surrey.

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LIVERPOOL, 2. 13, Rumford St., Central 1558
GLASGOW, C.2. 93, Hope Street, Central 9969

Personal

Mr. A. T. W. TAYLOR, a director of Stokes, Taylor & Shaw, Limited, has been appointed to the board of International Combustion (Holdings), Limited.

Mr. D. M. WILSON has been appointed representative in north-eastern England and Scotland for Easterbrook, Allcard & Company, Limited, engineers and small-tool manufacturers, of Sheffield.

At the Institution of Works Managers' conference at Southport, Capt. J. K. P. EDWARDS was presented with the Sir Henry Fieldes' award, by Lord Piercy, president of the Institution.

Mr. H. E. DIXON, who has accepted a senior appointment with Richardson Westgarth Atomic, Limited, resigned from the staff of the British Welding Research Association on November 30.

LORD MCCORQUODALE, a vice-president of the British Employers' Confederation and chairman of McCorquodale & Company, Limited, has been elected chairman of the British Productivity Council.

Formerly in business for many years in Marshgate, Doncaster, as an engineer and ironfounder until his retirement, Mr. J. W. FLOWER, of Lincoln, celebrated his golden wedding on December 2.

Officers elected at the annual general meeting of the Junior Institution of Engineers on November 30 included Mr. J. E. GRAY (chairman) and Mr. P. CAMERON and Mr. W. C. C. BALL (vice-chairmen).

Mr. GEORGE DIXON WILLIAMS has received presentations on retiring after 44 years with James Brown & Sons, Limited, brassfounders, etc., of Middlesbrough. For the last 33 years he has been the firm's cashier.

Mr. H. BROWN, who has been appointed assistant traffic manager (home) of the traffic department of the Metropolitan-Vickers Electrical Company, Limited, had since 1926 been with Ferranti, Limited.

Mr. ARCHIBALD G. PRENTICE, steel plant manager at the Cargo Fleet Works of the South Durham Steel & Iron Company, Limited, Middlesbrough, is leaving to take up an appointment in Scotland. He joined the Middlesbrough concern seven years ago.

Mr. LESLIE M. SAYERS has been appointed assistant general manager of British Railways, London and Midland Region, in succession to Mr. E. S. HUNT, who is retiring. Since August, 1954, he has been divisional operating superintendent at Crewe.

Mr. H. G. IVATT, managing director and general manager since February, 1955, of Brush Bagnall Traction, Limited, a member of the Brush Group, Limited, retired on December 1. He will remain on the board. Mr. F. H. WOOD has been appointed manager.

Mr. K. H. COLLINSON, 35, Free School Lane, Halifax, has been appointed honorary treasurer of a fund—estimated to require £3,000—for the Institute of British Foundrymen's conference to be held next year at Harrogate, and organized through the West Riding of Yorkshire branch.

Eight employees including Mr. L. G. PRISCOTT, company secretary, and Mr. JOHN DARBY, sales manager, received gold watches on December 5, for 40 years' service with Herbert Terry & Sons, Limited, Redditch. Thirteen other employees received certificates and £5 each for 25 years' service.

After 45 years' service with W. Shaw & Company, Limited, steel founders, Middlesbrough, Mr. HERBERT THORNTON, foreman moulder, has retired through ill-health. He was presented with a wallet of notes on behalf of the staff and his colleagues by Mr. Geoffrey Shaw, chairman of the directors.

Mr. ARTHUR W. BELL, of H. Bell (Machine Tools), Limited, Leeds, has been elected president of the British Association of Machine Tool Merchants (Incorporated) for the ensuing year, with Mr. HERBERT WIDDOWSON, of Herbert Widdowson & Sons, Limited, Nottingham, as vice-president.

Brigadier G. KELLETT, director of the Inspectorate of Armaments for the past three years, is retiring this month and will be succeeded by Colonel W. P. T. ROBERTS. Mr. HARRY BUTTON, inspecting officer of the Nottingham area of the Directorate of Inspection of Armaments, is also retiring shortly.

Mr. W. D. STONE, secretary of the Willenhall firm of John Harper & Company, Limited, stated on November 30, that the firm is contemplating using the inland waterways for delivery of bulk loads. He said the basic petrol ration would be just enough for one of the fleet of lorries to make a single journey to London each week.

G. & J. Weir, Limited, Glasgow engineers, announce the appointment of Mr. LUKE FRASER as London manager as from January 1, 1957. Mr. Fraser was previously Scottish sales representative and this position will be filled by Mr. FORREST T. RANDELL, from the Cardiff branch office. Mr. A. C. SMITH, former London manager, has returned to the head office in Glasgow, as sales director.

Mr. LESLIE STEPHENS has been appointed director of the Institute of Personnel Management in succession to Mr. M. B. FORMAN who resigned the post to take up an appointment with the National Coal Board. Since 1946, Mr. Stephens has been principal of Fircroft Working Men's College, Birmingham. Earlier he was for seven years with the Factory Department of the Ministry of Labour and National Service.

Mr. STANLEY SEYMOUR, founder and works director of Seymours' Castwell Foundry Limited, Raynesway, Derby, left England for Canada on December 7. He hopes to settle in Vancouver, and obtain a position as a castings buyer or on the managerial side of the foundry business. He will still remain a permanent director of the Derby firm, of iron and non-ferrous founders and patternmakers, which he established in 1948.

Belfast Harbour Board's harbour engineer for the past 15 years, Major J. H. A. PATTON is retiring at the end of this month. Major Patton, who entered the board's service in 1921, is succeeded by Mr. J. McF. NEILL, who has been in the service since 1928 and who has been Major Patton's chief assistant since his appointment as harbour engineer. Mr. M. AGAR, Mr. Neill's new assistant, has been with the board for the past 10 years.

AMONG eight new members of Council of the Industrial Welfare Society, the following have direct connections with the foundry industry: Mr. HERBERT HILL, chairman, Birfield, Limited, a group including Laycock Engineering, Limited; Kent Alloys, Limited, and Phosphor Bronze Company, Limited; Mr. J. L. DANIELS, chairman and managing director, T. H. & J. Daniels, Limited, and Mr. LEWIS LEVY, director, George Cohen, Sons & Company, Limited.

The Council of the Organization for European Economic Co-operation has appointed Dr. ALEXANDER KING, C.B.E., deputy director of the European Productivity Agency. On January 1, 1957, he will succeed Mr. EDWIN FLETCHER who has returned to the Trades Union Congress, from which he was seconded in 1955. As a chief scientific officer in the Department of Scientific and Industrial Research, Dr. King has been responsible for work on productivity, technical information services and overseas scientific relations.